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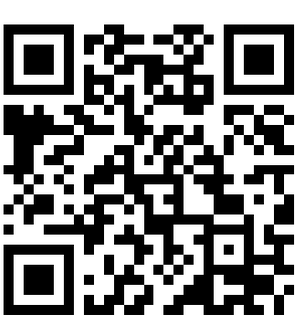

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THE TRAMWAY AND RAILWAY WORLD

AN ILLUSTRATED REVIEW OF PROGRESS IN

ELECTRIC AND OTHER TRACTION

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THE Tramway & Railway World
WITH MOTOR TRAFFIC SECTION

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TRAILER CARS IN BIRMINGHAM.

AN EXPERIMENT WITH THE SINGLE-DECK TYPE.

For a considerable time the question of the adoption of trailer cars in the city of Birmingham has occupied the attention of the Tramways Committee. Unfortunately, owing to shortage of labour, and the difficulty in obtaining materials, due to war conditions, the experiments decided upon by the Tramways Committee have been intermittent and delayed. Besides this the tramways department has recently experienced considerable interruptions to its traffic on account of a shortage in the supply of electricity which, for tramway purposes, is taken from another department of the Corporation. This again has prevented various details that otherwise would have been obtained from being placed at our disposal; but we hope to publish these at a later date.

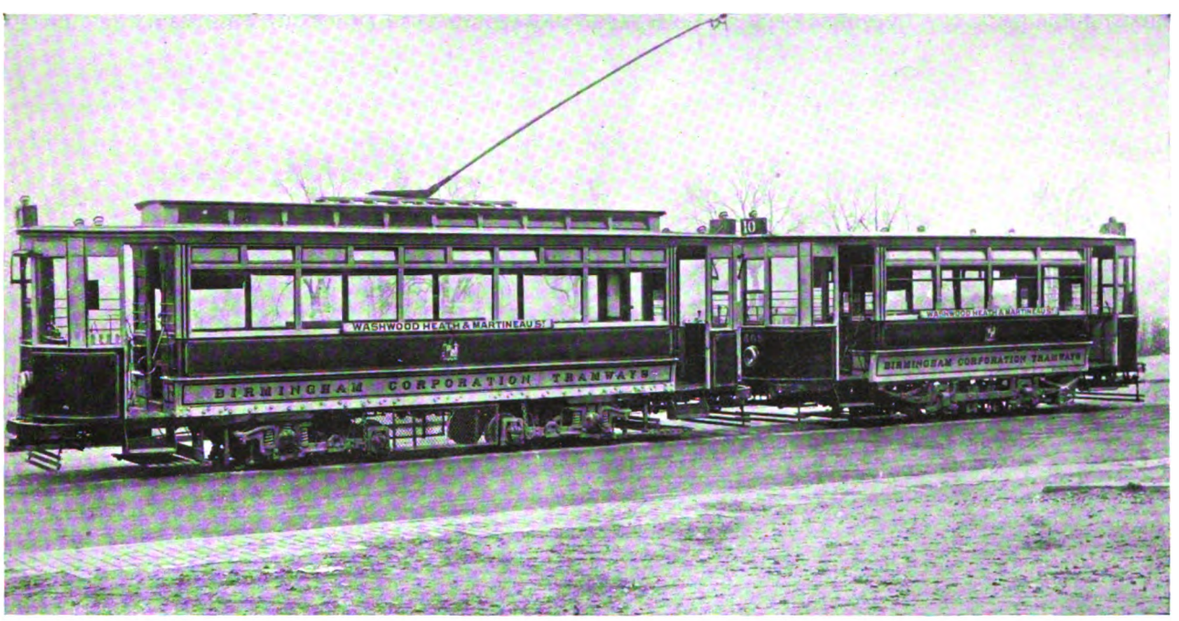

Fig. 1.—Single-Deck Motor Car and Trailer—Birmingham Corporation Tramways.

The Tramways Committee have, however, recently placed on one of their routes a single deck tractor and trailer car (Fig. 1), in order to ascertain the best type of car for Birmingham conditions. As far as the experiment, which is, after all, a reversion to Continental practice, has gone, it may be said that the tramways department is more than satisfied with the result.

Birmingham is peculiar in being the only large city in the country with narrow gauge (3 ft. 6 in.) tramways. To a very large extent the streets traversed by the tramways are narrow and tortuous, and the gradients are numerous and more or less severe. It is, of course, understood that the factor of safety with a single-deck car is considerably greater than with the double-deck top-covered cars now being operated by the Corporation, and it may be said that this factor has had considerable weight with the Tramways Committee in inducing them to experiment with single-deck vehicles. It is early as yet to say how far the experiment will be carried, or whether it will be extended to other routes in the city.

The advantages of single-deck cars are well known to tramway men, and are pretty obvious to the man in the street. They are claimed briefly to be as follows :—

(1) A greater factor of safety in operation, especially on heavy routes and narrow gauge tramways.

(2) The possibility of obtaining a better time schedule, due to the fact that passengers have not to mount and dismount from the upper deck.

(3) The fact that passengers are under better control in mounting and dismounting from the cars, the conductor being on the platform all the time, and not on the top deck, as is frequently the case at stopping places. Claims for accident compensation in this respect should be considerably reduced.

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(4) Repairs and maintenance ought to be considerably less, particularly for the car bodies.

(5) The probability that the permanent way will suffer less from single-deck cars than from the heavier double-deck cars.

The riding of single-deck cars in Birmingham over bad track (which unfortunately exists to some considerable extent on account of shortage of labour) is much better than with the other type. It is to test these matters that the Birmingham Corporation are making the experiment, and the result, when ascertained, will influence the Tramways Committee as to how far they will go in the direction of superseding the ordinary double-deck car by single-deck vehicles.

As may be seen from Fig. 2, the idea is very simple, but it is nevertheless very effective. The movement necessary to release the brake blocks from the wheels is only 5 in.

In addition to the automatic brake is fitted a hand brake of the usual Birmingham standard for four-wheel trucks, which can be applied from either platform and operates on the outside of the wheels.

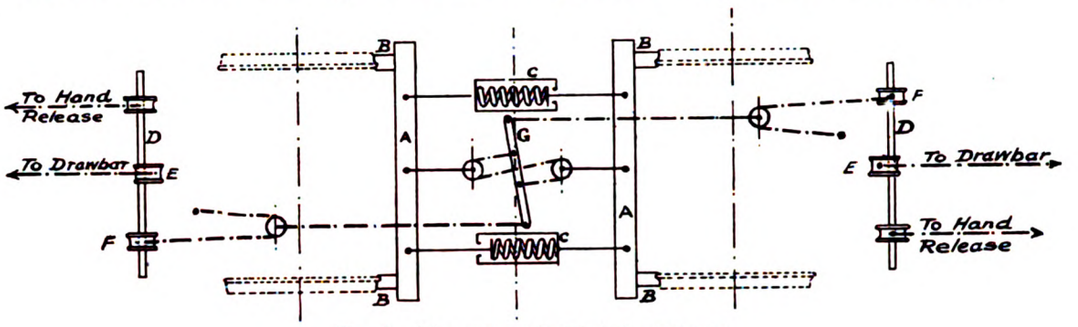

Fig. 2.—Diagrammatic Sketch of Brake.

A. Brake beams. B. Brake shoes. C. Actuating spring cylinders. D. Revolving shaft suspended from car body. E. Quadrant fixed to shaft D. F. Drum fixed to shaft D. G. Floating lever.

The couplings are of the A.B.C. type, which are also used on the London County Council cars, the socket being placed on the tractor and the tongue portion on the trailer, as shown in Figs. 3 and 4.

The trailer truck is of the Corporation standard pattern, and is of the four-wheel type, having a wheel

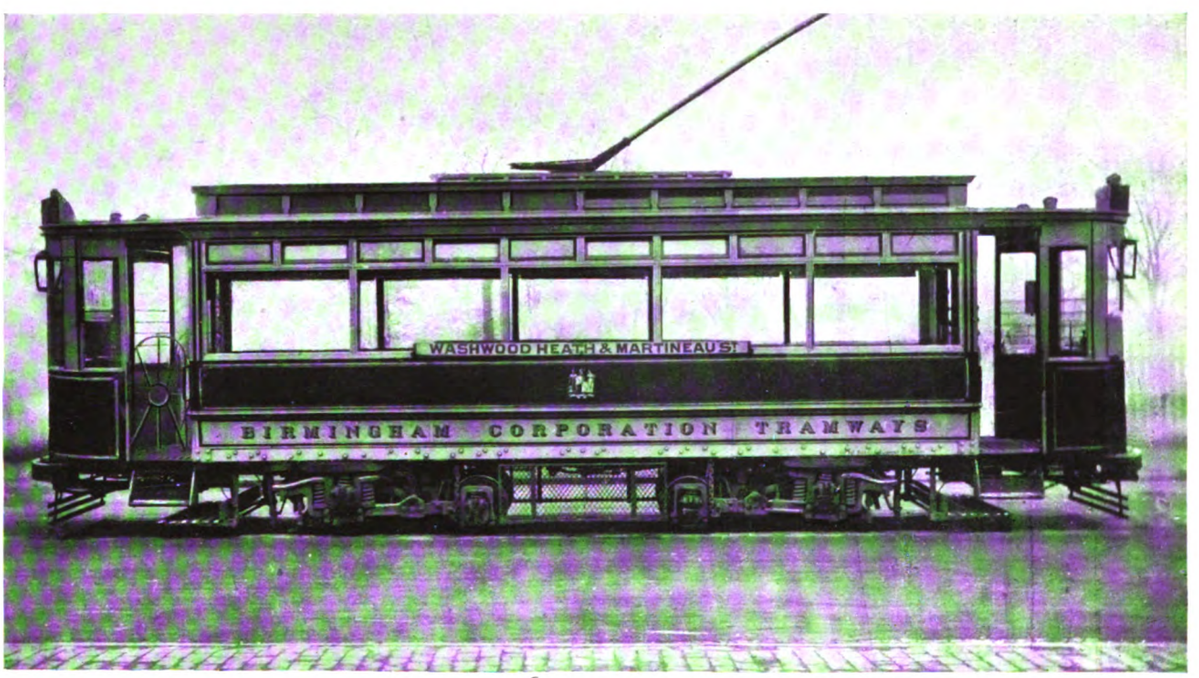

Fig. 3.—Single-Deck Motor Car.

After due consideration of various suggested types of automatic brake gear, necessary to comply with the Board of Trade regulations relating to trailers, it was decided to experiment with the type which had been for some time in use on the London County Council trailer cars, and was described in these columns in October 19, 1915. Certain special adjustments have, however, been made in order to adapt the apparatus to the Birmingham 3 ft. 6 in. rail gauge, a slightly shorter car body and longer wheel base being necessary. It has not been necessary to alter the brake, and this is identical with that used on the London trailer cars.

base of 7 ft. The tractor truck is of the bogie type, with which 75 double-deck cars have now been running successfully in this city for three years, having a truck wheel base of 4 ft. and extreme wheel base of 14 ft. 6 in. This is fitted with a Maley magnetic slipper brake, with means of energising the magnets with current direct from the trolley wire, and also with a run-back preventer.

The car bodies are of the single-deck type with vestibule ends, the trailer being a converted double-deck open top body, whilst the tractor is a converted double-deck car with top covered body, the lower roof

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being rebuilt and the monitor added. The platforms of both cars have each two entrances to enable passengers to mount or alight at either end and either side, and these entrances can be kept closed by iron ornamental scrollwork gates. These swing on hinges fixed to the inside of the vestibule end pillar, and may be fastened back to the inside of the vestibule.

No difficulty has yet been experienced in signalling. The conductor of the tractor does not give the signal to start until he himself has received the signal from the conductor on the trailer. Risk of accidents to passengers, consequent upon the use of whistles for signal purposes necessary for double-deck cars, is thus greatly minimised.

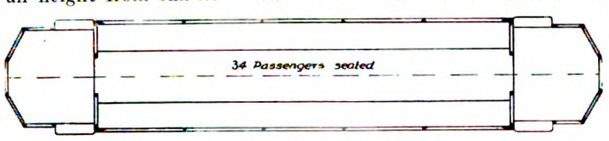
Fig. 4.—Single-Deck Trailer, showing Tongues of Couplings.

Fig. 5 shows the accommodation for passengers of both tractor and trailer.

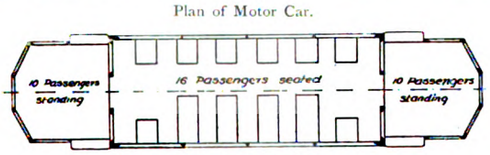
The leading dimensions of the cars are as follow :—

TRAILER.

Extreme length over couplings	29 ft. 10½ in.
Length over spring fenders	28 ft. 5½ in.
Over corner pillars	15 ft. 7½ in.
Extreme width	6 ft. 3 in.
Height inside	6 ft. 10 in.
Full height from rail	9 ft. 11 in.



Plan of Motor Car.



Plan of Trailer Car.

Fig. 5.—Plan of Seating Accommodation on Motor Car and Trailer.

Passengers seated	16	Total 36
Passengers standing on each platform for smoking (10 each)	20	

TRACTOR.

Length over collision fenders	34 ft. 8 in.
Over corner pillars	23 ft. 8 in.
Extreme width	6 ft. 3 in.
Height inside	7 ft. 11 in.
Full height from rail	11 ft.
Passengers seated	36
Standing (7 front, 10 back)	17
Total	53

The total number of passengers carried on the two cars is therefore 89.

The current for lighting the trailer car is carried through a connector fitted to the canopy.

ENLISTMENT OF TRAMWAY EMPLOYEES.

A SUBSTITUTION SCHEME.

Some weeks ago Mr. C. J. Spencer, hon. secretary of the Municipal Tramways Association, in an interview with Lord Derby, director-general of recruiting, made various suggestions for a scheme of substitution which it was hoped would enable tramway undertakings to obtain the men required for operating the cars, while it would secure desirable men from the tramway staffs for military service. Subsequently a deputation of the Municipal Tramways Association, comprising the president (Mr. Henry Mozley), the hon. secretary (Mr. C. J. Spencer), and Messrs. J. B. Hamilton, A. R. Fearnley, J. M. McElroy, and A. Baker, waited upon Lord Derby, and as a result details of a substitution scheme were arranged.

Under this scheme all fit men under 30 years of age excepting specially skilled men in responsible positions are to be released. The tramway authority of each municipality will supply to the War Office a list of men who have left their service and taken up military duties, giving name, previous occupation, rank, unit, regimental number, etc., together with a list of the men of military age at present employed, classified as "A" or "B1," stating age, occupation, marital condition, and medical classification. Every man released from the tramways will be replaced by a man of low medical category taken from the army who was previously employed on the tramways.

The lists of men on home service, and also on overseas service, are to be made out separately and forwarded to the secretary, War Office, S.W. (reference D.R.4.).

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STANDARDISATION OF POINTS AND CROSSINGS.

A Plea for More Standardisation, with Particular Reference to Tramway Track Work, viz., Points and Crossings.

By Fred Bland.

What are standards, and where and how can they be used to the benefit of tramways undertakings owned by Corporations or by companies? Taking England and Scotland, there are at present, according to the last return of the Board of Trade, 171 tramways belonging to local authorities and 108 belonging to companies; and probably out of the total of 279 60 per cent. had different rails when originally laid, together with varying lengths, radii, and angles of points and crossings, on the different tracks. Although many have been replaced, there are still a great proportion to be relaid, and this is the time when economy, combined with improved tracks, smoother running and consequently improved comfort to passengers, can be secured.

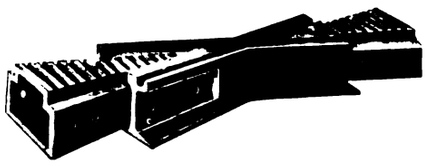

Fig. 1.—Frog Crossing.

Fig. 2.—Leg Crossing.

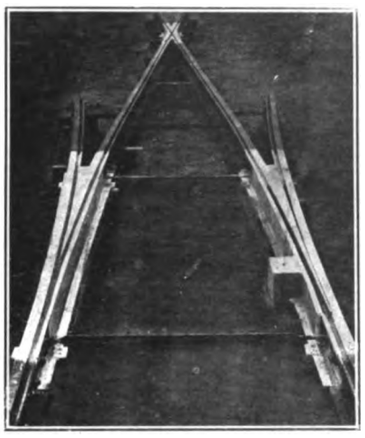

Fig. 3.—Automatic.

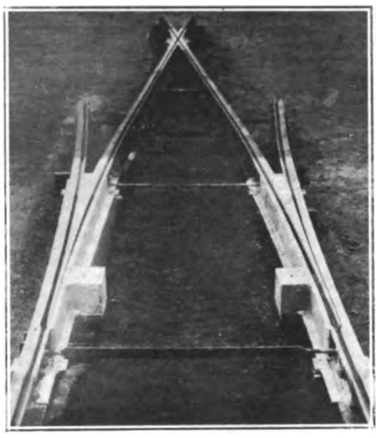

Fig. 4.—Independent Automatic.

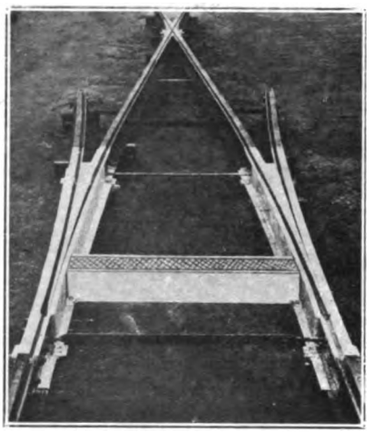

Fig. 5.—Connected Automatic.

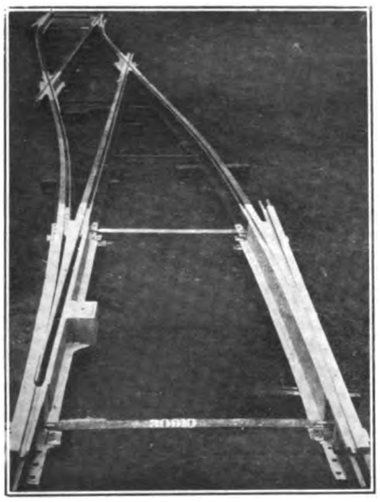

Fig. 6.—Left-Hand Movable.

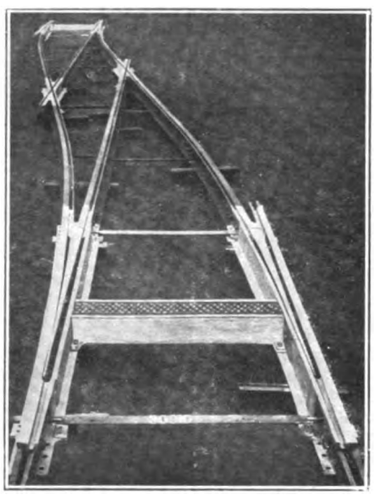

Fig. 7.—Connected Movables.

The first consideration is the rail. It is now impossible to obtain the various sections of rail originally used, and the makers, when they do roll, will confine themselves to British standard sections, with a great probability of these being reduced to one, or at most two, with sections of 6½ in. and 7 in. Consequently the great majority of those requiring rails will find it desirable to accept either one or the other. A few Corporations who have adopted a standard rail of their own design, and who will probably continue to use that section, may be left out of the question.

The second question, and one of great importance, both to consumers and to manufacturers, is that of points and crossings. Given two sections of rails, the makers of special work could afford to stock standard sizes, and so to cheapen production, and also to expedite delivery. This will not only become an urgent question "when the war is over," but in many cases is *now* urgent, although still postponed either on account of price, labour, or various other causes. There are numerous tracks which are not only greatly out of repair, but will very soon become dangerous unless relaid or otherwise attended to. Postponement will not save money or reduce the cost, as wages, living, raw material, fuel, and taxation are not likely to fall for a long time, and will probably never return to pre-war rates.

When the war is over there will be many matters requiring attention; and to postpone the discussion of standardisation of material until that time will mean further delay, and indeed it would then be too late to gain the advantage that may now be secured. Now is the time to

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consider this question, and to arrive at some general understanding.

Take any track not yet relaid, or only partially so.

Loops.—It will usually be found that these can be relaid to the benefit of the rolling stock, etc. When the existing points are 7 ft. 6 in. to 9 ft. long, with crossings of angle 1 in 5 to 1 in 6, there is no difficulty in replacing these points with standard points 12 ft. long, keeping the same angle of crossing. Where existing crossings are of the "frog" or lug type (Fig. 1), they should be replaced with the "leg" type of crossing (Fig. 2), thus permitting of the cutting out of the "hammered" rail ends.

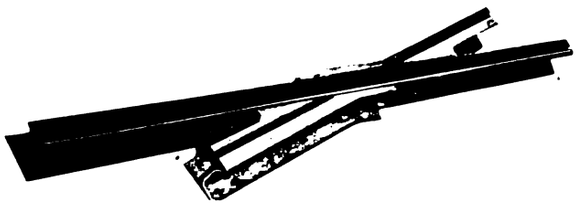

Fig. 8.—Unbroken Wing.

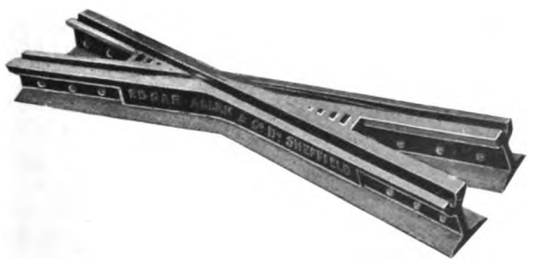

Fig. 9.—Unbroken Solid Crossing.

Where new rails are used, then a first-class job can be made, and on busy loops it will be found more economical to use new rails (when they can be obtained) and transfer the partly worn rails to less used portions of the track (Figs. 3, 4, 5).

Crossovers.—Standard points, 12 ft. long, should also be adopted, with 100 or 150 ft. radius, as most convenient. The crossings should also be relaid with the extended "leg" type as on loop ends (Figs. 6, 7). When the crossovers are for emergency use only, and rarely used otherwise, it will be found economical to take out the crossings entirely, and relay with straight through rails (thus ensuring smooth running and reduced car maintenance), and connect up the two tracks by "wing crossings" forming an "unbroken main line" track (Fig. 8). If solid crossings are still preferred, then these can be made with one groove filled up to ensure the "unbroken" run, but there will be two joints as against *none* with the through rail type (Fig. 9).

Junctions.—When renewing junctions, the short "frog" crossings should be replaced by "leg" crossings, all extended and connected together, without intermediate pieces of rail. Where, however, the junctions are too flat for the six crossings to connect, then the centre four crossings, or diamond, should be connected (Figs. 10 and 11).

All points for junctions should be 12 ft. long of the double tongue type, connected together on the facing end and working independently on the trailing side, thus using the same type of point. There is a tendency on the part of some engineers to revert to the old type of dummy or fixed point on the trailing side (but the running is not so smooth), or alternatively one moveable point with an open point on the trailing side (Figs. 12 and 13).

Curves, when relaid, should have a manganese guard attached on the inside rail with a solid manganese rail as the outer rail, or preferably both rails should be of solid manganese, according to the position and traffic.

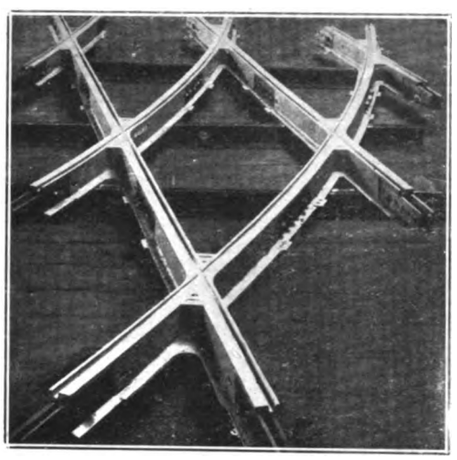

Fig. 10.—Junction Crossings.

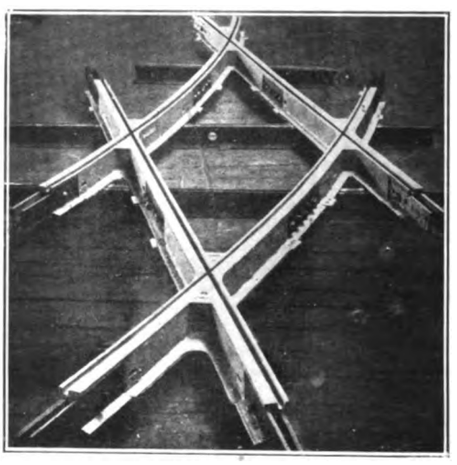

Fig. 11.—Diamond Crossing.

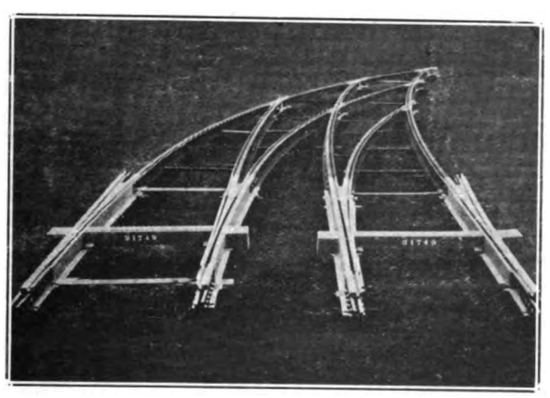

Fig. 12.—Connected Movable Points on each Track or Without Connection on Trailing Side.

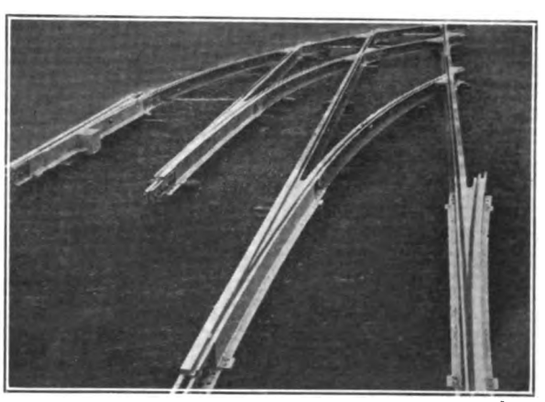

Fig. 13.—Movable and Open on Facing Side with Open Points on Trailing Side.

Surveys.—All tracks to be relaid should be inspected, and new surveys made with a view to improvements

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and standardising. Experience has proved how much can be done in this matter at a small cost. Points which can be considered standard are as follows :—

LATERAL.

(*a*) 100 ft. radius × 12 ft.
(*a*) 150 ft. ,, × 12 ft. or 12 ft. 6 in.
(*b*) 200 ft. ,, × 13 ft. 6 in.

EQUILATERAL.

(*a*) 200 ft. radius × 12 ft.
(*c*) 250 ft. ,, × 12 ft.
(*b*) 350 ft. ,, × 15 ft.

SPECIAL.

75 ft. radius × 10 ft.

(*a*) Chiefly used.
(*b*) Occasionally used.
(*c*) Rarely used, while 240 ft. × 11 ft. 2 in. is the standard adopted upon all British Electrical Federation tramways.

Crossings.—At present the crossings used vary from 1 in 4½ to 1 in 9, and in length from 6 ft. 6 in. to 11 ft., according to manufacturers' patterns, but the standard angles are 1 in 5 and 1 in 6. To permit of three fish-holes, 4 in. centres, two bond-holes, and one tie-bar hole to be in each leg of the crossing, the lengths must be 8 ft. and 9 ft. respectively (Fig. 14).

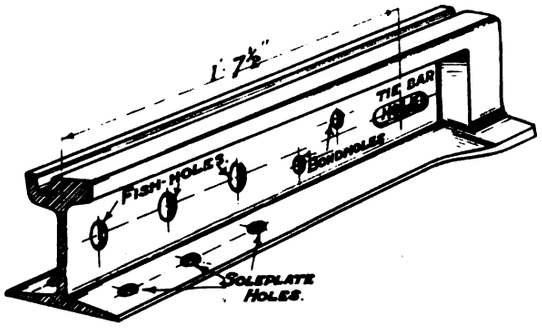

Fig. 14.—Fishplate Recess.

Finally, having presumed that tramway engineers accept these views, then let them agree to demand certain lengths and radii so that points and crossings can be interchangeable. The first stage of simple standards will then have been reached in supply and demand.

Manufacturers can then afford to stock the standard requirements, which so far has not been done, because of existing variations, which have been increased year by year for the benefit only of individual undertakings. It will be greatly to the interest of tramway proprietors, engineers, and manufacturers if a "common ground" to work upon can be found, but no standardisation can be effective unless the manufacturers do co-operate.

While it is impossible to say that such and such a standard must be used, experience has shown that the standard designs suggested will cover 90 per cent. of the ground. The case for their serious consideration is consequently so st ong as to appeal to all concerned in the economical and efficient maintenance of tramway track. The Engineering Standards Committee have devoted considerable attention to this question, and will, I hope, before long issue their recommendation with standard tables, etc.

Meantime I venture to think that the question as to what renewals are required and what form those renewals should take is an important and pressing one for tramway engineers to consider and decide before and not "after the end of the war."

Goods Carriage in Mexico City.—Freight of all kinds is carried on the tramcars serving Mexico City and its suburbs. The cars are run in trains of two, the motor car being for first-class passengers. One end of the second-class car is partitioned off for freight.

TRAMWAY GOODS SERVICE IN THE BLACK COUNTRY.

In view of various schemes now more or less matured in several places for the carriage of merchandise by tramways, traders may find it useful to note that for upwards of five years the Birmingham and Midland Tramways Joint Committee have been running a service of freight cars over all their lines in the Black Country, connecting up Birmingham, Walsall, Dudley, Stourbridge, and many other places.

In our issue of March 11, 1915, an illustrated article was published giving an account of the parcel and goods service carried on by the Birmingham and Midland Tramways Joint Committee. A few points may be recalled for the purpose of elucidating the most recent developments which are hereinafter noted. The tramway parcel express, as it was originally called, was inaugurated by the committee representing five tramway companies as far back as November 1, 1905. The tramways in Birmingham were at that time part of the associated undertakings, and the parcels were carried on the car platforms both inside and outside the city. In 1906 the tramways in Birmingham began to pass into the hands of the Corporation. The last of them to be municipalised was the main parcel express tramway route into the Black Country. This line came under municipal management in June, 1911. The cars of the Joint Committee, however, continued to have access to the centre of Birmingham, and the parcel service continued to develop. The tendency was for trade packages to get heavier and beyond the capacity of the ordinary car platform. Moreover, the Corporation of Birmingham were averse to the carrying of parcels on the car platforms within the city, and it became necessary to devise some new method. Hence the idea was evolved of baggage cars constructed to take packages of any reasonable size or weight. These cars were devoted exclusively to parcel and goods traffic, and ran to a schedule time table. The passenger cars on the branch lines continued to take parcels, but on the main lines the baggage cars were (and are) employed. They afford a regular service between all parts of the Black Country tramway system and Birmingham.

To come now to the recent developments, especially during the last two years has the service proved invaluable for the quick transit of munitions and foodstuffs. Frequently the railways have been congested with traffic, and grave delay would have been unavoidable in conveyance and delivery but for the existence of the service of the tramway express.

Since the publication of the article in our issue of March 11, 1915, additional baggage cars have been brought into use, including a baggage car and trailer. This last addition has a total carrying capacity of 10 tons, i.e., eight tons in the car and two in the trailer. The fleet now comprises six baggage cars, of which five are in daily service. These cars are capable of carrying a total load of 40 tons.

The diversity of traffic in the Black Country is very noticeable. Potatoes in 10-ton loads from agricultural districts, bombs in the rough and munitions of war generally from the Black Country into Birmingham, Wolverhampton, etc., and margarine, cocoa, foodstuffs, and tobacco in cases from Birmingham to the adjacent districts.

One result of the war, as far as it relates to the Black Country tramways, has been to convert the business from an ordinary parcel business into a goods business. Six years ago there were no baggage cars and the front platforms of the passenger cars were piled roof-high with flimsy parcels and newspapers. Now

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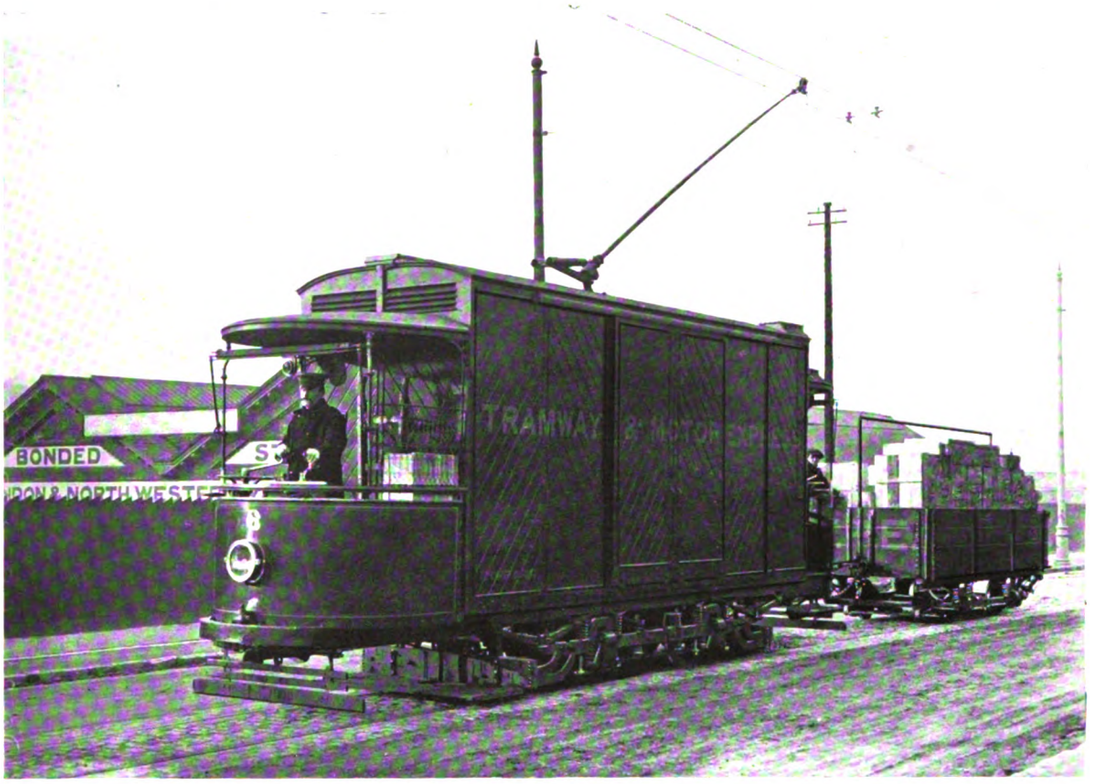
practically all the traffic is carried in the special baggage cars, and it is of such a character that it cannot be accommodated on the platform of a tramway car. Parcels carried by motor omnibuses are of the more ordinary kind, but even here the effect of the war has made the parcels perceptibly heavier.

In the case of certain portions of the Black Country tramway system special powers are obtained for making sidings into works, and on several occasions the company have endeavoured to make use of these powers, but so far no works have been found sufficiently large or enterprising to promise a steady traffic of sufficiently large dimensions to warrant the relatively heavy expenditure that would be required on points and crossings.

Partly, no doubt, as a result of the lively discussion at the last conference of the Municipal Tramways Association, the utility of the carriage of goods on tramways has recently been considered afresh in



Baggage Car and Trailer in use by the Birmingham and Midland Tramways Joint Committee.

several localities, and, as indicated above, in some places schemes have already been partially worked out. In at least one city the plans will soon, we understand, be put into practice, and it is not unreasonable to anticipate that before long many tramway systems will take their share in a movement that may grow to be of considerable national importance. Those who desire to examine the matter more closely may be referred to the paper contributed to the Municipal Tramways Conference in September last by Mr. G. W. Holford, general manager of Salford Corporation Tramways, and Mr. W. Clough, general manager of Bury Corporation Tramways. It was published, together with a full report of the discussion thereon, in our issue of October 12 last. The paper contained a great deal of useful information as to what has been done in the way of utilising tramways for goods traffic and as to the powers under the law of municipalities to carry on such a business.

THE ROTARY CONVERTER.

The rotary converter has for many years proved its great worth in electric sub-stations, and for traction purposes in this country it is more largely employed than any other type of converting machine. It combines in one machine the functions of a motor and a generator, and possesses simplicity and efficiency for its work of converting alternating current into direct current. As time has gone on improvements have been made in the machine, until now it is a wonderfully perfect piece of mechanism. The characteristics of the operation of the rotary converter are well described and copiously illustrated in a useful booklet just issued by the British Thomson-Houston Company.

After an explanation of the voltage ratio between the a.c. supplied to the machine and the d.c. which it produces, the section on armature heating contains some interesting points. Incidentally those who are not electrical experts will learn why it is that in many converters six slip-rings are used instead of three in the conversion of three-phase current. The current in the armature winding is the difference between the a.c. and the d.c. currents. The difference materially decreases by increasing the number of phases up to six. It is therefore usual to equip modern converters for three-phase systems with six slip-rings. The six-phase winding results in a cooler machine and one having a higher overload capacity and efficiency. In regard to commutation, it is shown that the conditions under which it takes place in the armature of a rotary converter are superior to those in the armature of a d.c. generator. It is also claimed that the rotary has a higher efficiency and a greater overload capacity than other types of converting apparatus.

One of the sections of the book which is of special interest as containing a great deal of new and original matter is that dealing with variation in voltage ratio.

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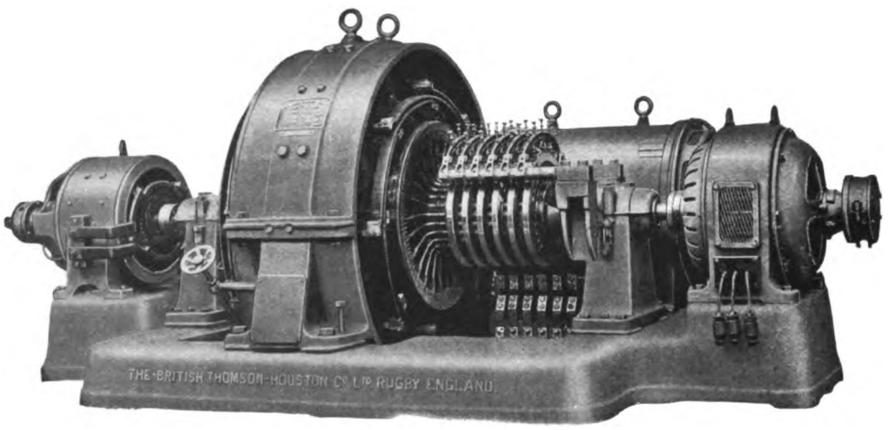
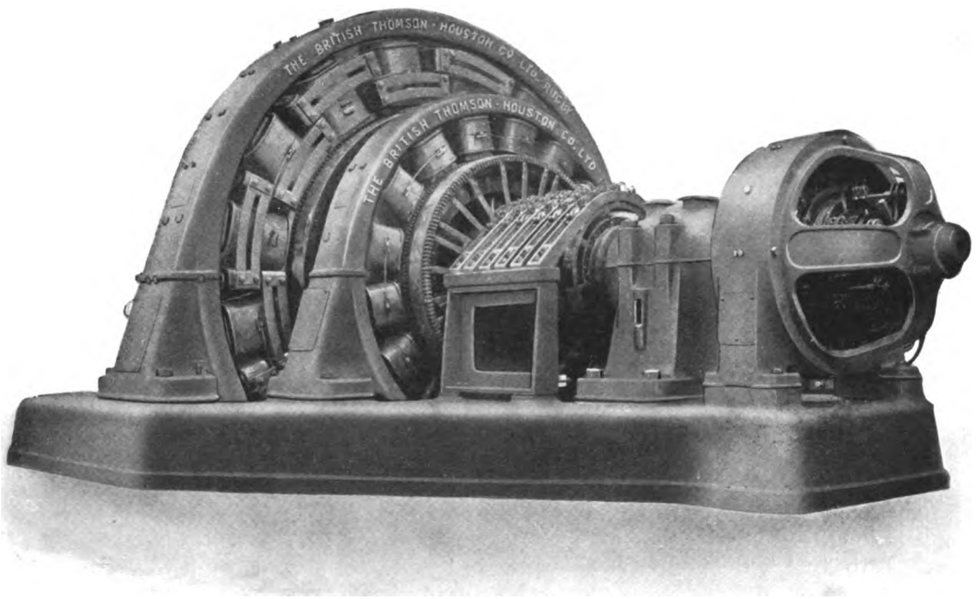
The principal methods which have been adopted for obtaining a variable d.c. voltage with constant a.c. voltage and *vice-versa* are reactance control, booster control, induction regulator control, and split pole control. The view is taken that the reactance method is the cheapest and simplest, and it is generally installed for conditions of service which do not require more than 10 to 15 per cent. voltage variation, and where independent control of the power factor is not necessary. In order to vary the d.c. voltage, the slip-ring voltage is varied, even though the applied voltage at the high-tension terminals of the transformer remains constant. This control is effected by the introduction of reactance in the transformer, or by means of a separate external reactance. If the field of the rotary be adjusted to draw a lagging current, the effect of the reactance is to lower the slip-ring voltage; while if the field be adjusted to draw a leading current, the effect of the reactance is to raise the slip-ring voltage. Where rotary converters are installed for operating on both lighting and traction bus-bars, reactance-controlled machines are admirably suited. The transformer can be provided with a lighting tap which will enable the converter to run on either lighting or traction bars.

In regard to booster control, this consists of inserting an a.c. booster between the slip-rings and armature of the converter. The booster increases or decreases the a.c. voltage applied to the armature, and so raises or lowers the d.c. voltage. With booster control unity power factor can be obtained, and machines with this control have been constructed for all capacities and frequencies. Since the introduction of commutating poles in converters, however, it has been found that if the booster be used to vary the voltage over wide limits on full load the commutation has been seriously affected. This can be remedied by fitting inductive diverters, or by applying auxiliary windings to the commutating poles.

Induction regulator control is the latest phase in the development of this class of machine. The d.c. voltage is varied by inserting an induction regulator between the transformer and the rotary slip-rings. The regulator increases or decreases the a.c. voltage applied to the rotary armature, and so raises or lowers the d.c. voltage. The power factor is independent of load or voltage. The method is similar in arrangement to booster control, and will perform the same functions, with, however, the important advantage that the factors which control the commutating conditions are independent of the amount of voltage variation. Machines accordingly can be supplied of the largest output for a given size, without diverters or auxiliary windings, and are capable of 30 per cent. voltage variation and more should occasion arise. This method of control was widely adopted some years ago, and the recent improvement consists in having the regulator mounted on the converter itself. This arrangement takes up less floor space and reduces the first cost to the level of that of the booster machine. The regulator is connected between the a.c. brush-holders and terminal board of the converter, and there are no external connections. The economical design of regulators of large capacity at first presented some new problems, but these have been solved. Induction regulator controlled rotary converters are often installed for correcting a low power factor, the machines being arranged for operating on 90 per cent. leading power factor at full load at any voltage. In regard to split-pole control with a two-part pole, it has only been developed for 25-cycle work, and is suitable for a voltage range of 25 per cent. Unity power factor can be obtained under any condition of



500-kw. Induction Regulator Controlled, Self Synchronising Rotary Converter, with A.C. Starting Motor and Separate Exciter.
(Induction Regulator mounted on far side of base-plate.)



1,500-kw. Booster Controlled, Rotary Converter, with Direct Coupled Exciter.
(This machine is running on power, lighting, and tramway service, and is arranged for D.C. starting.)

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load and voltage, and the control is the simplest that has been devised where voltage variation is required independently of the power factor.

A useful description is given, along with diagrams of connections, of the different methods of starting rotary converters. This is followed by fully illustrated details of the construction of British Thomson-Houston types of these machines.

TOWN PLANNING AND TRAMWAYS.

VIEWS OF THE CHAIRMAN OF BIRMINGHAM CORPORATION TRAMWAYS COMMITTEE.

Councillor Harrison Barrow, chairman of the Birmingham Corporation Tramways Committee, on December 8 read a paper entitled "Housing and Town Planning After the War" at a meeting of the Town Planning Institute, from which extracts are given below. The author remarked that before the war there was a serious shortage of houses, and during the past two years the number built had been negligible. The average number of new houses required every year was 100,000. If the war ended a few months hence 300,000 houses would be required, and, in addition, there were 600,000 houses not fit for habitation which ought to be pulled down. Councillor Barrow emphasised the following points in what would be the situation after the war :—

(1) That we must not waste money and lives by allowing our great cities to grow in the haphazard and casual way in which they are now growing. We cannot afford the loss of time caused by the congestion of our narrow roads and the inefficient means of communication ; and the men returning from the trenches will not consent to live in the slums, or in rows of houses crowded together.

(2) The war has shown our mean stupidity in not spending more money on housing and town planning. No other expenditure would produce more abundant return than this ; yet in the past the Government and local authorities have doled out money in a few paltry millions, and we have been told that it was impossible to find more, that the nation could not afford it.

COMPULSORY PLANNING ESSENTIAL.

It has been well said that the first essential is the planning out of the main roads. From experience of town planning in Birmingham, I know that it is impossible to decide on the main roads without very great consideration and a long period of negotiation and conference, and I doubt if it is possible to satisfactorily decide the main roads of a suburb under a period of one to two years, and then only if there are members on the local authority who will push forward the project with energy and ability.

On the other hand it is possible, in a comparatively short time, to decide on the number of houses to be built per acre on different zones ; I propose therefore that every town and urban district should be instructed to prepare maps, showing three zones. (Compulsion of some kind would have to be applied by Parliament through the Local Government Board.)

(*a*) The areas which have been developed for building purposes, where the roads have been constructed, and the land completely laid out for building purposes.

(*b*) Areas where the land has been partially laid out for building purposes, with roads laid out and partially constructed.

(*c*) Areas where the land has not been developed for building purposes.

The Local Government Board would examine the plans, and give a final decision as to the areas of these zones, and the following maximum densities of building would be allowed in the various districts :—(*a*) On this area not more than 18 houses to the acre would be allowed ; (*b*) 15 to the acre ; (*c*) 12 to the acre. I am basing these figures and this proposed arrangement on that followed in the East Birmingham Town Plan, which was for the development of a manufacturing side of the city where there is great variety in the character of the buildings. The proposals were objected to by one agent, but otherwise met with general approval.

WIDENINGS FOR TRAMWAYS AND OMNIBUSES.

I am anxious to keep this preliminary scheme as simple as possible, but I see no reason why arrangements should not be made for securing land for widening the most important main roads. I therefore propose that towns should be encouraged (I do not think that compulsion could be applied in this case) to include in their preliminary scheme plans for the widening of all main radial roads which are now, or obviously will be, required in the near future for tramway purposes or for omnibus routes. This would not apply to roads the frontages to which are fully built up. Such scheme of widening to merely secure in the future sufficient land to enable the roads to be widened (to at least 80 ft.), and not to necessitate any expenditure, on the carrying out of any works until they are actually required.

Mr. Walter Long said on October 31, in reply to the deputation representing the conferences of local authorities which have been held to formulate schemes for the construction of arterial roads in Greater London, that he should consider it his duty to advise the Government that their first call upon public funds ought to be for the provision of housing of our people, and for sanitation and water supply. I submit that the proposals I have made will not entail any expenditure, or very trifling, and that it would be a great misfortune if the large number of houses required to be built after the war were allowed to be erected without some restrictions as to their density and position.

Mr. Walter Long's reply in regard to the arterial roads in London was not absolutely negative, and he did promise to endeavour to preserve the suggested routes from further obstructive buildings, and said that Sir George Gibb (head of the Road Board) should consider the proposals. The work of the conferences has occupied, I believe, about three years, and this fact shows what care and consideration is necessary before any such scheme can be evolved.

I would therefore most strongly urge that a similar series of conferences should be held in the provinces to consider the main arterial roads.

INTER-URBAN TRAMWAYS ON SLEEPER TRACK.

As chairman of the Birmingham Tramways Committee, I am particularly interested in the possibilities of the extension of tramways and light railways for inter-communication between towns and districts—not only for passenger traffic, but also for goods. The success of such schemes depends largely upon securing wide roads and laying the tramway rails on sleeper track by the side (or in the middle) of the road. The saving of paving between the tracks is about £3,000 per mile, and the cost of the land required at £100 per acre would only be £300. In addition there would be saving in the cost of maintenance, and the running expenses would be lessened on account of the greater speed at which cars would be run. I mention this to show the importance of wide roads connecting centres of population.

The tramways and light railways would also traverse country areas, and much might be done in carrying vegetables and fruit, etc., into the towns and carrying out manure, etc., to the country districts. In Birmingham, on our ordinary tramway system, the department is carrying about 80,000 tons per annum at a pre-war cost of 2½d. per ton per mile.

There is a theory in some quarters that towns should not run tramcars outside their borders, as they are thereby developing roads not in their own areas. This is a false view to take, as the more efficient inter-communication makes for progress, and the most profitable arrangement, from a rating point of view, would be to have all the factories in a town, and all the houses of the work-people outside, but whether the particular town benefits or not does not matter. We have had too much of such parochial selfishness ; we must do that which is best for the nation as a whole.

The question has been raised as to who should pay for this extra width required for tramway purposes. I think that it is clear that the tramway authority should pay for this, and it will probably be necessary to have a joint committee representing various local authorities to work the tramways connecting several towns. This question, however, does not come within the limits of this paper, but requires to be mentioned to complete the proposal.

JUDGMENT REGARDING CENTRE POLES.

On December 10 Sheriff Shennan gave judgment at Hamilton in the action Henry K. Frood *v.* Lanarkshire Tramways Company. The action arose out of pursuer's motor car colliding with an unlit centre pole in Motherwell. The Sheriff has found that pursuer's averments were irrelevant, and insufficient to support the conclusions of the initial writ, and has dismissed the action, finding the defenders entitled to expenses. The Sheriff stated that the poles were in the centre of the roadway by the authority of Parliament. They were no more a legal obstruction than were the houses in the street or the kerbs in the footway, and defenders had no duty to the public imposed on them to give warning of the existence of the poles. As to the pursuer's further contention that it was the duty of defenders to take special measures to obviate difficulties under the lighting restrictions by painting the poles white, his Lordship stated that that also was negatived. The defenders' argument was conclusive that the pursuer, being merely one of the public, had no title to found on Clause 13 of defenders' Order of 1903 an obligation to light all centre poles in Windmillhill Street. That clause was expressly described as containing certain provisions for the protection of the Provost, Magistrates, and Councillors of Motherwell. Being in a private Act, it embodied a contract between the two parties to it, and no one else could enforce that contract. On the question of deficient lighting the lighting authority was responsible, viz., the burgh authorities.

New Work at Plymouth.—The Tramways Committee have instructed their engineer to construct a new terminus at Drake's Circus, utilising the short length of disused line in Old Town Street for the purpose, and to extend the West Hoe section to Drake's Circus, instead of stopping at the Theatre Royal. The fare on the section is to be increased from ½d. to 1d., thus making the penny fare universal.

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LONDON, JANUARY, 1917.

The Past Year.

In the operation of tramways the past twelve months have been one long struggle both on the management and the engineering sides against formidable difficulties. That our tramway chiefs have for the time being grappled successfully with the situation is shown by the fact that on the great majority of the undertakings the traffic receipts continue to show substantial increases. The scarcity of labour has, of course, become more acute as more and more men have gone to the army. Something like 30,000 employees are now with the forces. Women are employed in increasing numbers, in some cases even as drivers, and this has somewhat eased the situation, although it has added greatly to the anxieties of managers. The substitution scheme which was arrived at towards the end of the year may help in checking further depletion, but it is questionable whether any considerable number of tramway employees now in the army will be found medically unfit for active service but still fit enough for their old occupation. In any event a point has been reached when it is quite impracticable for additional men to be released for the army unless efficient substitutes can be found for them. As respects repairs and maintenance, the managers are faced with a very serious condition of affairs. Even if they have the labour, they cannot obtain the materials. Supplies can hardly be got at any price; only by special permission of the Government can any considerable quantity of steel materials be obtained. To meet the increasing cost of material and the high wages that have to be paid, fares have in some cases been increased, but there is much difficulty in this direction. In view of the Government action whereby railway fares have just been increased by 50 per cent., tramway authorities may find it desirable to reconsider their fares also. Some relief is being found in regard to the wage bill by those towns which operate coupled or trailer cars, as for the two cars only one driver is required. The reports which have been issued during the year show that on the whole the financial position meantime is fairly satisfactory; but it must, of course, be discounted by the accumulating arrears of maintenance and renewal work.

Railway Electrification.

The year has been characterised by some important developments in the application of electricity to railway working. For the most part these were enterprises which were entered on before the war began, and though on account of scarcity of labour and materials there have been delays, most of the electrification work on hand has been completed. Early in the year electric operation began on the Manchester to Bury section of the Lancashire and Yorkshire Railway involving 22 miles of track. This is the first example in England of the use of 1,200-volt direct current with a third-rail conductor. Another important innovation which was completed during the year lies in the adoption of 1,500-volt direct current traction with overhead wire conductor for the Shildon to Newport line of the North Eastern Railway. Apart from the Holcombe Brook experimental line, this is the highest direct-current voltage yet employed for traction in England. The line also is the first purely mineral railway to be electrified in this country. It is 18 miles long, with 50 miles of track including sidings, and the locomotives can haul trains of 1,400 tons. In the latter part of 1915 the London and South Western Railway began working

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electrically one suburban route, and during the past year the whole of the company's suburban lines, comprising 47 route miles, came under electric operation. A third section of the electrification of the suburban lines of the London and North Western Railway was completed, and the only parts of the scheme, which extends to 41 route miles, not yet worked electrically are those between Willesden and Watford and a shorter length from Euston outwards. Naturally there has been little progress on the European continent, although the Italian Government has added to the mileage of its electric railways. But some notable undertakings have been completed on the other side of the Atlantic. The most important of these is the electrification of 440 miles of the mountain section of the Chicago, Milwaukee and St. Paul Railway. This is now partly in operation, and it is the biggest trunk line electrification that has yet been accomplished. The locomotives are the most powerful in the world, and they can haul goods trains of a weight of 2,500 tons. The conversion to electric traction of the suburban railways of Melbourne is in progress, but it has been greatly retarded by the war conditions. In due time, however, it will become an installation that will bear comparison with the most important undertakings of the kind in Europe. It is being constructed under the direction of British engineers, and the electrical equipment is being manufactured in this country.

Business After the War.

We have from time to time during the past year sketched the somewhat uncertain progress of movements in this country for developing British trade after the war. Something has been done, but much remains to be accomplished as regards the adoption of an imperial policy and the systematic promotion of industry on a scale equal to the necessities created by the war. From the declarations of the Government and from the temper of the nation it is, however, plain enough that after the war the British producers of electric tramway and railway equipment will not be subjected to the same keen competition from Germany and Austria which they experienced before the war. Whatever may be the precise steps taken to reduce that competition, there can be no doubt that it will be reduced if not abolished. There is thus much reason for encouragement as to the prospects of what may be termed normal business in the future. But before the stage of normal business is reached, there will be an immense amount of arrears to be made up. Ever since the war began we have had the growing restriction on the execution of maintenance and renewal work. Nothing involving material expenditure has been done unless it was absolutely impossible to postpone it, or unless it was required for war purposes. The longer the war lasts the greater will be the accumulation of work to be taken in hand as soon as is at all practicable. The Local Government Board have recently obtained from local authorities estimates of what expenditure will be necessary on their various undertakings, including tramways, after the war. The total when completed will run into a very high figure. To take one example, the Leeds tramway undertaking alone anticipates an expenditure of £160,000. The Local Government Board have no doubt to consider in advance the prospects of loans being authorised, and the Government will have something to say as to the distribution of labour set free from the army. Thus it behoves our manufacturers of steam and electric plant, rails, cars, supplies of every kind, to be setting their houses in order as far as possible for the work which is coming upon them. A victorious peace may be longer delayed than many anticipate, but it cannot be so far off as to make unnecessary careful and detailed plans for dealing with the situation which will follow. From tramway undertakings, as from other industries, will come a long pent-up flood of orders. Tramway and electric railway extensions will also be taken in hand. Throughout British overseas dominions, as well as in territories of our Allies, similar conditions will arise, and Government stimulus, combined with private enterprise is likely to produce an immense expansion of export trade. Both at home and abroad therefore the opportunities of our manufacturers for some time after normal conditions have been restored will be very great, and those who are sufficiently enterprising to make their plans well in advance will find their foresight richly rewarded.

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Edinburgh Tramways Decision.

We may congratulate both the Edinburgh Corporation and the Edinburgh Tramways Company on the eminently sensible compromise that they have reached with regard to the immediate future of their tramway problem. As is well known, the present lease of the tramways to the company expires in June, 1919, and there had been a desire on the part of the Town Council not to perpetuate the cable system beyond the period of the lease. As reported in our issue of September 14, the consulting experts had advised the Corporation that as far as technical considerations were concerned arrangements could be made for the change over to the electric system without interrupting the cable service, and that the new installation could be ready for operation at the expiration of the lease. In normal circumstances this could no doubt have been done; but national considerations are paramount, and as indicated in the discussion of the matter in our issue of September 14, the idea of the expenditure of half a million pounds on the provision of a new installation when there already exists a fairly efficient and adequate tramway system could not be entertained. The Ministry of Munitions in due course intimated that they were unable at present to sanction the necessary expenditure, and consequently the use of the cable system must be continued for some time to come. The Corporation still desire to assume the management of the tramways at the end of the lease. The tramway company are, however, the owners of the cable cars, and it was clear that unless the Corporation could arrange for the purchase of these Edinburgh might be deprived of its tramway service because it would be impossible for the Corporation to obtain cars from any other source. The company had, however, no wish to hamper the Corporation, and they have made what seems to be a very reasonable offer to sell the cars to the Corporation on the termination of the lease. They have also made satisfactory proposals in regard to some other points which have hitherto been in dispute, and the Tramways Committee have recommended the acceptance of these proposals by the Town Council. The proposed arrangement offers an equitable adjustment of the whole of the questions at issue, and there is little doubt but that the Town Council will accept the company's proposals. If this is done the Corporation will come into the actual possession of their tramways, the power stations, and the present cars in two and a half years; and the cable system may be continued without interruption until such time as conditions become more normal and the conversion of the system to some form of electric traction becomes financially practicable. The present system is sufficient to provide an adequate tramway service. The speed, which has been a good deal criticised, is, as a matter of fact, as high on the average as on many electric tramways. Much of the dissatisfaction with the cable cars which has arisen within the past few years has been due no doubt to inadequate maintenance, and as the company have recently taken steps to remedy this difficulty, there seems to be no reason why the Edinburgh public should not be contented with the arrangement which has now been reached.

NEW OMNIBUS ROUTES.

PROTEST AGAINST SURREY COUNTY COUNCIL'S CHARGE.

In consequence of the heavy charge that Surrey County Council proposed to impose on the East Surrey Motor Traction Company for a new service in the Lingfield district, the company have withdrawn the service. A meeting of the residents has been held, at which a deputation was appointed to convey to the County Council the objection entertained to the tax by the people of the locality. Mr. F. Cobham, who presided, urged that many other vehicles did as much damage as the omnibuses, and he urged that if any tax was imposed it should affect all vehicles according to weight. Mr. E. Turner read a letter from Mr. Joynson Hicks, M.P., who opposed the new war time restriction in the House of Commons, stating that the tax was a return to the old turnpike era. The roads were made for public use, and the omnibus was the poor man's motor. The speakers agreed that the omnibus service developed the district in the absence of an adequate railway service, and that the ratepayers could afford to make good any damage caused to the roads.

Liability of Irish Guaranteeing Areas.—In the Chancery Division at Dublin, Mr. Justice Barton has dismissed with costs the suit of the Wicklow County Council *v.* the Dublin and Blessington Steam Tram Company and the Dublin County Council, in which plaintiffs claimed the declarations that the total liability of the guaranteeing area was limited to 1s. in the £ (Poor Law valuation) in any one year, and that the arbitrator's award of June, 1916, so far as it purported to place liability on plaintiffs, was unenforceable or only so to the extent of 1s. in the £. His Lordship held that the Wicklow Council's guarantee was not limited to 1s. in the £, and that the guaranteeing area in County Wicklow is bound to pay the full amount necessary to make up the 5 per cent. guaranteed dividend, and also a share of the loss on working expenses, subject to any Treasury contribution that might be received. He held that the bond referred to in the arguments was *ultra vires*, and that it should not have been entered into.

No Loan for New Cars. Plymouth Tramways Committee have received a letter from the Board of Trade with reference to their application for sanction to borrow £8,600 for the purchase of eight new cars, stating that on the information before them the Board were not prepared to sanction the loan. Under present conditions loans could only be sanctioned for expenditure that could not be avoided, postponed, or reduced.

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INADEQUATE POWER STATIONS.

BIRMINGHAM'S TRAMWAY TROUBLES OVERCOME—EXTENSIONS ELSEWHERE.

It was with great relief that the travelling public of Birmingham learnt on December 18 that the Electric Supply Department having installed additional machinery, the Tramways Committee anticipated being fully able from that date to maintain the services. With the exception of a stoppage for several hours on December 20, due to the bursting of a steam-pipe, the anticipation has been realised. As readers are aware, the stoppage of tramway traffic that has had to be suffered during certain periods of the day since the middle of October was due to a breakdown at the Summer Lane station, and the inability of the Supply Department to secure the additional plant required to meet the demand entailed by munition work.

At the December meeting of Birmingham Corporation, the Electric Supply Committee were directed to furnish the Council with a summary of the advice which the engineer has given them since January 1, 1911, on the probable necessity for increasing the generating power at the stations and of their action thereon.

Councillor Harrison Barrow called attention to the serious losses upon the tramways in consequence of the vagaries of the supply department. It was possible the committee might not be able to hand over anything to the relief of the rates. He estimated that the loss in consequence of the stoppages since October 14, allowing the same percentage of increase as they had been having during the whole of this year, amounted to about £26,000. There had been no saving in expenditure; in many cases it had actually increased. The loss was considerably more than the actual loss in revenue. In three separate weeks the loss had gone from £2,500 to £4,600 and £3,600. Many people had taken season tickets on the railway, and they would not get them back until those tickets had run out.

Alderman Jephcott, chairman of the Electric Supply Committee, observed that they had been up against the Government in respect to the demand for munitions, and had not been able to meet the tramway demand because they had not got the machinery at the time they were led to expect it. Had the committee gone to the Council before the war commenced with a suggestion for a rapid development of the electric supply, they would have been laughed out of court. Since they understood the Government's great demands for current, they had increased their output within the past two years from 80 million units to nearly 100 million units. In the temporary station at Nechells they had made provision that would make it within two years as large a station as even Summer Lane itself was designed to be. When they got their new 6,000 KW. plant in, they would have had 18,000 kilowatts installed within eighteen months, so that it could not be said they had been dilatory in regard to provision for war purposes.

EXTENSIONS AT SHEFFIELD, BELFAST, AND SUNDERLAND.

Following the recommendations of the Sheffield Electricity Committee in favour of providing a new generating station, the Parliamentary Committee have advised Sheffield Corporation to promote a bill in the present session of Parliament to enable the scheme to be carried out.

On the recommendation of the Tramways and Electricity Committee, Belfast Corporation have decided, pending the extension of the generating station, to decline further applications for the supply of electricity unless the applicants are prepared to take it at the time switch rate. The Council have also resolved to see if the site already agreed upon for a proposed new station is still available, and to ask Sir John Snell to advise them as to what modifications, if any, he would suggest being made in his report of August, 1914, on the question of the extension of the electricity undertaking. Councillor McCaughey, chairman of the committee, said the Council made a mistake in listening to the deputation that asked them to stay their hand a few years ago.

The Ministry of Munitions have sanctioned an expenditure of £45,000 for new plant for the Hylton Road Works of Sunderland Corporation. A tender for a new turbo-alternator, which forms part of the scheme, has been accepted.

CAST-STEEL WHEELS WITH MANGANESE TREAD.

Something of a novelty in wheels for electric cars has been introduced by the American Steel Foundries, of Chicago. This is a cast-steel wheel with a manganese steel tread and flange and a ductile steel plate round the hub. The cost of this Davis wheel, as it is named, is about that of a rolled steel wheel, while the life is similar to that of a cast-steel wheel, or even better. The method by which the two kinds of steel are incorporated in one casting, says the *Electric Railway Journal*, was devised specially for the manufacture of the Davis wheel. It includes revolving the mould in which the first metal entering is treated with ferro-manganese during its passage from the ladle into the mould, where the centrifugal action throws it to the wheel-tread and flange. As the pouring continues, the manganese steel rim is gradually blended into a ductile steel plate and hub by tapering off the ferro-manganese treatment.

The manufacturers claim the advantage of this wheel is that it retains the one-wear principle of the cast-iron wheel, and at the same time secures greater strength, safety, and a lower maintenance cost. It also avoids the disadvantages of a rolled steel wheel introduced by turning which must be followed by adjustments in the bearings and brake rigging whenever wheels are changed. The following are service data for 83,000 Davis wheels under 40 and 50 ton equipment:

Periods of Service:

4,000 in service for 3 years and 11 months.
10,400 in service for an average of 3 years and 7 months.
59,600 in service for an average of 2 years and 7 months
83,000 in service for an average of 2 years and 4 months.

Record of Service:

Worn wheels removed	69	(1½ per cent.)
Damaged wheels removed	60	(1⅕ per cent.)
Defective wheels removed	56	(1⅕ per cent.)
Slid-flat wheels removed, re-ground and returned to service	482	(7/12 per cent.)
Total number removed, eliminating "slid-flats," which have been re-ground and put back in service ...	185	(⅛ per cent.)

Only 56 wheels were removed because of defects, out of a total of 83,000.

Other important claims for this wheel are that cars are not held out of service as long as would be the case when wheels are turned, and the higher resistance to wear maintains a practically uniform wheel diameter throughout their life in the trucks. Fewer wheels are also required in stock because turning is unnecessary and this also tends to reduce the labour materially. In order to insure perfect rotundity, the treads of all Davis wheels are ground to contour, and this greatly minimises the possibility of wheels sliding when the brakes are applied. In addition, each wheel is tested with a sclerescope for uniform hardness, and it is also taped to determine the uniformity of diameter.

The extraordinary strength and resistance to wear obtained by the combination of metals in the Davis steel wheel, makes it possible to produce them in weights lighter than could be obtained with any other metal. Moreover, being a one-wear wheel it carries no added thickness at the rim and this, together with other reductions in the wheel sections, makes it approximately 20 per cent. lighter than the cast-iron or the multiple-wear steel wheels. Actual tests have shown that this product has a flange strength of approximately eight times that of a cast-iron wheel under an impact test and four times that of a cast-iron wheel under a static load test. These tests also indicate that these wheels have a strength equivalent to that of rolled-steel wheels.

GOODS TRAFFIC ON TRAMWAYS.

To the Editor of THE TRAMWAY AND RAILWAY WORLD.

Sir,—Mr. Mozley distinctly stated that the authors were wrong in saying there was no power for a tramway undertaking to make sidings to works other than those owned by undertakers. The authors were more general, and used a term which meant it was not general.

I have already stated there are one or two isolated cases, but unfortunately for Mr. Mozley, Burnley is not one of them, even though he called it in aid.

Whether attached as a manager to either company-owned lines or municipal, it is obvious both are subject to the conditions of the Act or Order under which the powers are obtained.

Mr. Mozley says I must become a municipal manager before I can understand why the municipal mind and the company mind cannot coalesce. Well, without holding this honourable position, experience shows it quite possible, as instanced by the Tramways and Light Railways Association, which has the honour to enjoy the membership of the representatives of some very important municipal undertakings.

When I first had the pleasure of knowing Mr. Mozley he was suffering from the disability of not being a municipal manager. Any improvement since by the change must be, psychologically speaking, spiritual, as I have not discerned any particular advancement on his well-known previous ability.

Has Mr. Mozley never heard of an emulsifying agent by which the most stubborn opposites are forced to coalesce? In this case, the only emulsifying agent required is common sense.

I am invited to study the psychology of local authorities from the *inside*, which sounds more like a doctor's job. I can imagine his Worship the Mayor of Burnley, strongly resenting such a diagnosis by me, even though I might be strongly recommended by his tramways manager.

Yours faithfully,

36, Victoria Street, STEPHEN SELLON.
London, S.W.,
December 28, 1916.

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A NEW SCHEME FOR CHICAGO.

ESTIMATED COST, £20,000,000.

A report by the Traction and Subway Commission of the city of Chicago has been published, setting out a scheme for improving the means of local communication in the city. The commissioners are Messrs. W. B. Parsons, Robert Ridgway, and Bion J. Arnold, with Mr. H. M. Brinckerhoff as chief engineer. The total expenditure contemplated is about 100,000,000 dollars, the work to be spread over nine years, divided into three equal periods. The first part proposed to be concluded in 1920 calls for an expenditure of 60,500,000 dollars in round figures; the second period involves 24,500,000 dollars, and the third period 11,300,000 dollars. The scheme also provides for an ultimate development which by the year 1950 would provide for a city of five million inhabitants at an estimated cost of 260,000,000 dollars.

The recommendations of the commissioners provide for the unified operation under one management of all Chicago's local transportation facilities with the control vested in the City Council, giving to a board of supervision the broadest possible powers as to improvement and regulation of services, development of the property, extension of facilities, etc. It is proposed that the existing companies should surrender their present franchises and receive in lieu thereof a franchise to a new corporation. The city's present traction fund will be used for the construction of the proposed subways. The divisible net receipts are to be shared by the city in such a way as to facilitate the acquisition of the properties. Various financial arrangements as between the city and the company are outlined. Among these is a provision that after allowing for a sinking fund, the net receipts should be divided between the city and the company in the proportion of 55 per cent. to the former and 45 per cent. to the latter.

The nine years' construction programme will increase the rapid transit facilities two and a half times, and calls for the construction of eleven single track miles of double track subway, of which six miles are for rapid transit cars and five miles for surface cars; 6½ single track miles of elevated lines; 150 miles of new surface lines; and 111 miles of reconstructed surface track. The ultimate plan provides for the construction and equipment of 58 miles of subway and 525 miles of surface lines.

The general plan requires the construction of four north and south rapid transit lines. Two of these will pass through the present loop district, and the other two will be further west. The east and west rapid transit lines will intersect the above four lines for transfer arrangements at points of intersection. This system is to be extended as may be necessary from time to time. At convenient points throughout the city transfer is to be provided from the surface lines to the rapid transit lines.

In regard to north and south travel, a line is to be developed by four-tracking completely the north western and south side elevated lines from Sixty-third Street on the south to Wilson Avenue on the north. The central portion of this line is to consist of a two-track subway, while the other two tracks are to be secured by the utilisation of the existing Fifth Avenue elevated tracks. By the provision of what are called stub services special facilities are to be given for rush hour traffic in the central district. Another through north and south line is to be established by constructing a two-track elevated railroad north from Sixty-ninth Street to Twentieth Street with certain connections at Twentieth Street which will connect with the existing metropolitan right of way with additional tracks constructed on it to Robey Street junction. From that point a two-track elevated line is to be constructed north to a junction with the existing Ravenswood branch of the north-western elevated. A two-track subway is to be built from a transfer terminal south of Sixty-third Street northward to Chicago Avenue, where it will connect with the State Street subway.

For the east and west rapid transit lines the plan contemplates additional tracks on the existing west side elevated lines to provide express services, extension of these lines into new territory, the construction of a new line into the south-western portion of the city, amplification of the existing trunk lines leading into the central business district, and the construction of additional trunk lines leading from West Side junction points by a subway through the central business district to Michigan Avenue or Grand Park.

In order to improve the communication from and to the north-western residential district a physical connection is proposed from the Metropolitan system to the Oak Park elevated lines at Lake Street. This will relieve the traffic on the Metropolitan main traffic lines.

In regard to surface line improvements, surface line subways are recommended on the score of necessity. Such surface line subways should be constructed through the congested central business district to form the nucleus of a down town terminal system of subways, into which as many surface line cars as possible should be diverted. These subways include a two-track line east under Washington Street to Michigan Avenue and Jackson Street; a two-track subway under Jackson Street to a connection at Michigan Avenue with the Washington Street subway; a north to south subway under Indiana Avenue from Fourteenth Street, thence under Michigan Avenue to a connection with the west side subways. These lines would enable the streets in the central congested area to be freed from many cars. They would also connect a number of steam railway termini.

The commissioners also recommend the immediate carrying out of surface line improvements and a strict enforcement of traffic regulations.

MOTOR OMNIBUSES IN THE U.S.A.

REPORT TO THE ELECTRIC RAILWAY ASSOCIATION.

At the annual convention of the American Electric Railway Association, held in Atlantic City, N.J., in October, the Committee on Motor Omnibus Operation, presided over by Mr. Britton I. Budd, presented a report on motor omnibus operation as distinct from the type of automobile known as the jitney, and it was considered, as a feeder, auxiliary or competitor of electric railways. A great deal of interesting data on the cost of omnibus operation was collected and was presented in an appendix. The conclusions reached by the committee from these data are briefly as follow:—

The motor omnibus has two distinct fields, one in direct competition with city or interurban lines, and one where it acts as a feeder to such lines or serves some community at a distance from steam, electric, or water transportation. For the former service, the rate of fare is practically limited to the rate of fare obtaining on existing transportation lines, and in these circumstances these omnibus routes cannot be commercially successful, as shown by the operating costs and demonstrated by the long list of failures. Where there is no competition, higher rates can be established so that it may be possible to run such a line at a reasonable profit providing there is sufficient business and the rate of fare is not prohibitively high. These instances are so few as to be negligible.

The difficulties of omnibus operation are further increased by the rapid depreciation of the equipment, owing to bad roads, and the difficulty of securing the services of reliable and careful men in their operation. Generally speaking, they are unable to exist if obliged to comply with regulatory laws such as electric railways are required to operate under, or to submit to similar taxation or other municipal charges.

The development of the petrol motor truck for hauling freight, express, and produce is another phase of the possibilities of the petrol engine as affecting existing transportation companies. Where the roads and weather conditions are favourable, this form of operation is making an impression upon the earnings of electric and steam lines, and it is quite probable that the motor truck for freight will develop, first, as a competitor to existing transportation lines, and, second, as a feeder for them. The committee, however, have not had an opportunity to make a comprehensive study of this particular part of the subject.

In the appendix, information is given about 68 routes for omnibuses that have been put in operation. A number of these have not proved profitable and have been discontinued. An important exception is the Fifth Avenue Coach Company, whose earnings are given as 35.29 cents per omnibus mile, and expenses 24.6 cents per mile with a 10-cent fare for between six and seven miles. Figures are also given of the estimated cost of operation per seat-mile for motor omnibuses, based on cars of five different types and prices, i.e., from a $500 four-passenger car to a $4,000 twenty-two-passenger car. The sum of the fixed charges and operating expenses per seat-mile are estimated to be from 0.95 cent to 2.42 cents.

ROADMAKERS FOR WORK IN FRANCE.

Mr. H. P. Maybury, engineer and manager to the Road Board, who has been on a visit to France with Sir Eric Geddes, Inspector-General of Transportation to the British Expeditionary Force, is raising a special battalion for dealing with the construction and maintenance of roads in France within the British area. The men will not be armed, and service will be for the duration of the war. The companies will be officered by road surveyors or public works engineers, the non-commissioned officers being chosen from foremen. Men over military age and up to 52 years are required, and they will be paid 3s. a day with clothing, rations, and such allowances as are paid to private soldiers who have wives and children. Mr. Maybury is receiving the co-operation of a number of surveyors, and the project has been brought to the attention of local authorities, who are informed that officers, men, and plant are urgently required. In Surrey, Mr. A. Dryland, the county surveyor, is raising two companies. The subject was brought to the notice of York City Council on November 13, when the Corporation agreed that the Streets and Buildings Committee should give every possible help in the matter.

A New Brake at Huddersfield.—The Board of Trade have approved of the new brake invented by Mr. R. H. Wilkinson, general manager and electrical engineer, Huddersfield Corporation Tramways, and have given permission for it to be fixed to each car.

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GOVERNMENT APPOINTMENTS.

Sir Albert Stanley, President of the Board of Trade.

Sir Albert Stanley, managing director of the London Underground Railways and the London General Omnibus Company is one of a number of business men who have been included in the new Government which was formed by Mr. Lloyd George, who on December 7 became Prime Minister. Sir Albert has become President of the Board of Trade. For some months past he has assisted the Ministry of Munitions as director of munitions transport. He received his knighthood on the occasion of the King's birthday in June, 1914. His work in the development of travelling facilities in and beyond the Metropolitan area has made his name well known in the transport world.

Although Sir Albert was born in Derby in 1875 his youth was spent in the United States, where he was educated in public schools and technical colleges, and thereafter devoted himself to electric railway work. For 12 years he was manager of the Detroit United Railways and the Public Service Railways of New Jersey.

After the Underground Electric Railways of London had completed their work of construction and equipment, Sir Albert came over from the States and took up the position of manager, becoming managing director on the resignation of Sir George Gibb. As the number of undertakings associated with the underground company increased by processes of amalgamation or exchanges of shares, so the sphere of his work widened until he became managing director of the Metropolitan District Railway, London Electric Railway, Central London Railway, City and South London Railway, London General Omnibus Company, and the Associated Equipment Company. He is also a director of the London United Tramways and the London and Suburban Traction Company, which undertakings are also associated with the Underground Company, and has played an important part in the consolidation of the various interests and in the organisation of the scheme of passenger facilities that those undertakings represent.

Sir Albert Stanley.

On the operating side of Sir Albert Stanley's labours for the transport companies of the metropolis several main principles clearly reveal themselves, and it is easy to see that they have been whole-heartedly carried out by the managers and heads of departments. The welding together of the various undertakings, which had been designed by separate companies without any thought of co-operation or for London's requirements as a whole, has necessitated ceaseless activity in several directions. Combined with a constant study of traffic needs in the central districts there has been the fostering of suburban localities. Much difficult engineering work has been carried out at the instigation of a master mind in order to increase the traffic-carrying capacity and speed of the underground railways. Several systems have been linked up, and all the chief stations on the District have been reconstructed in a manner that has been advantageous from three points of view, viz., to the public, to the operation of the railway, and to the financial profit of the company. Just as the war broke out, the great enterprise of bringing London's first "tube"—the City and South London Railway—up to modern requirements as regards dimension of the tunnel, the rolling stock, etc., had been entered upon. Above ground the motor omnibus and company tramway services have to a large extent been made available for exchange of traffic with the underground lines on through tickets.

Due recognition has been given to the task of developing latent talent among the official staff. One method is to be seen in the encouragement afforded to the exchange and discussion of ideas by a staff organisation at periodical "efficiency" meetings. Welfare work among the many thousands of employees in the liberal sense in which Sir Albert Stanley understands that branch of activity has made him a pioneer of such beneficent labour in the traffic organisations of this country. The men on the District Railway have recognised his interest in that respect by naming the fine social club provided for them the "Albert Stanley" Institute. Now that the war has brought women into the service in large numbers, similar facilities have been provided for their comfort.

Difficult though it has been on the part of a combined undertaking in its infancy to meet the demands of labour in the matters of wages and conditions, Sir Albert Stanley's policy has given satisfaction to the employees. Proof of this was afforded on July 24, 1914, when on behalf of 20,000 employees he was presented by Mr. W. A. Mandelick, the secretary, with handsome gifts on the occasion of his knighthood. At that ceremony representatives of the employees of the railways, omnibuses, and tramways expressed their thanks for the fair dealing that had characterised Sir Albert's treatment of the employees, and in his reply the new knight stated that if that was the feeling of the men he was amply repaid. At that time Sir Albert was on the point of taking a rest to re-establish his health, and it is gratifying to record that that object was fully achieved.

Not the least important feature in Sir Albert's policy has been the effective use of advertising as a means of teaching Londoners and others to become acquainted with the facilities for locomotion at their disposal, with consequent benefit to the traffic receipts of the allied companies.

Sir Albert's Views on his New Task.

On December 21 Sir Albert Stanley was elected unopposed as member for Ashton-under-Lyne, which was vacated for him.

In a letter of thanks to the electors of Ashton-under-Lyne, for his unopposed return to Parliament, he wrote: "It may be necessary to make new demands on the public and to appeal to them to make great sacrifices, so that the whole civil population may co-operate to the utmost in helping the new Government to prosecute the war with still greater vigour. Just at the time when the enemy is feeling the strain and the sufferings of a just retribution for plunging Europe into bloodshed, and cannot much longer endure, the Allies are rising to the height of their power and see certain and unquestioned victory in the near future. I am not a parliamentarian. I joined the new Government out of a strong sense of duty, simply to give such ability as I possess to the direction of the work of the Board of Trade as a business man."

Public opinion generally welcomed the selection of a successful business man and experienced organiser to fill an office which is closely connected with the prosecution of the war and the maintenance of our trade and industry. The work of the department has increased so enormously during the war that no one man could possibly control efficiently all of its branches. The offices are scattered in 20 different buildings between the Tower and Victoria Station, and it is an open secret that an entire reorganisation was indispensable. The marine branch, through the appointment of Sir Joseph Maclay as controller of shipping, will be transferred to a new department, while the food department will come under the food controller (Lord Devonport), and the new Ministry of Labour will no doubt take over the labour branch, including the employment exchanges and arbitration machinery. It is expected that the Board of Trade will retain administration of the railways, trading with the enemy, winding up enemy companies, patents, bankruptcy and the commercial department. Some interesting changes in organisation and methods of work may be anticipated. Sir Albert has appointed Mr. R. W. Matthew and Mr. E. R. Eddison as his private secretaries.

Director-General of National Service.

Mr. Neville Chamberlain has resigned the Lord Mayoralty of Birmingham, and has taken up the duties of Director-General of National Service at St. Ermin's Hotel, Westminster. There will be a military and a civil wing of the department, the former being directed by Major-General A. Campbell Geddes. Mr. Chamberlain has stated that it will be his duty to find labour for the essential industries, including munition factories, agriculture, mining, shipbuilding, and the various subsidiary and auxiliary trades, from among volunteers who will be asked to enrol. These volunteers may be expected to come partly from unoccupied persons and such as are now employed during part of their time, and also from certain trades, to be scheduled hereafter, which are not considered as essential to the nation.

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MINISTERS OF LABOUR AND AGRICULTURE.

Mr. J. Hodge, M.P., the first British Minister of Labour, is secretary of the British Steel Smelters' Society.

Mr. R. E. Prothero, the Minister of Agriculture in Mr. Lloyd George's administration, served as a member of the Royal Commission on Railways and of the Departmental Committee on the Home Production of Food last year. He is 64 years of age, is a barrister, an alderman of Bedfordshire County Council, and agent in chief to the Duke of Bedford.

STAFF WELFARE WORK.

REVIEW OF UNDERGROUND AND L.G.O.C. ACTIVITIES.

The eighth of the series of efficiency meetings of the operating department of the London Underground Railways and London General Omnibus Company Group was held on December 13 at the L.G.O.C. Training School, Milman's Street, Chelsea, Mr. H. E. Blain, the operating manager, presiding over an audience numbering nearly 200 officials. Papers on "Staff Welfare Work" were read by Mr. J. Thornton (chief inspector, District Railway) and Mr. H. Lansdown (assistant general superintendent, L.G.O.C.).

Mr. Thornton, in his paper, observed that when Parliament began to safeguard the interests of employees, social welfare work in its modern application commenced to receive proper attention. The various activities in this direction, so far as the Underground Railways were concerned, were described, these including five mess-rooms and six institutes, the establishment of the last-named commencing on the Central London Railway in 1901. The various sports and other clubs were described, and well-deserved tribute was paid to the organisation known as the T.O.T. Mutual Aid Fund, which had disbursed over £100,000 in supplementing the allowance paid to the dependents of employees with the colours. Other developments mentioned were the Approved Society under the National Insurance Act, the ambulance corps, and the new T.O.T. staff women's dining and social club established at Earl's Court.

Mr. Lansdown's paper described social welfare work as not being philanthropy, a fad, culture, or factory Red Cross work, but as a practical, useful, commonsense thing, implying fair treatment for employees, involving good conditions and good feeling between employer and employed. The qualifications and duties of staff welfare superintendents were discussed, it being advocated that they should be concerned in the interviewing of applicants for employment, in providing new employees with recommended lists of houses or apartments, in the inspection of mess-rooms, in recording and investigating bad time-keeping, as well as in the organising of social functions. An interesting review was given of welfare work in connection with the Ministry of Munitions, Rowntree's Factory, York, the Spirells Factory, Letchworth Garden City, and on the New York railways, the L.G.O.C. activities in connection with staff welfare concerts, work in connection with the women conductors, the 23 mess-rooms, the various garage institutes, the rifle range facilities at seven centres, the Grosvenor Road choir, and the various garage sports clubs. Suggestions were made for extension of the work, and, in conclusion, a definition was given of such work as being "a humane relationship between master and man."

Both papers were illustrated with slides, and evoked an interesting discussion, the evening being one of the most successful of the series. A number of excellent suggestions were forthcoming, and the chairman stated that he would arrange for the appointment of a committee to report on the whole question of co-ordinating and extending the social welfare work.

The attendance included, on the railway side:—Messrs. Murray Griffith (director), J. C. Mitchell (treasurer), A. R. Cooper (engineer), J. L. B. Lindsay (assistant secretary), W. E. Blake (superintendent of the line), S. J. Webb (passenger agent), and, on the L.G.O.C. side, Messrs. G. J. Shave (engineer), J. P. Thomas (general superintendent), Captain Rozier (superintendent of employment), H. Dawson and R. Johnston (claims department), W. E. Hammond (traffic manager, Metropolitan Electric Tramways), and the chief members of the controlled staff of the various affiliated companies.

WELFARE ADVISOR FOR TRAMWAY WOMEN.

The shortage of men and youths in December compelled Bristol Tramways Company to employ young women as conductors. Bearing in mind the development instituted by the Welfare Branch of the Ministry of Munitions in connection with Government work, Mr. Charles Challenger, the manager of the company, has engaged a woman welfare advisor for the benefit of the new class of employees. This lady assists the staff in the selection of the candidates for instruction, and throughout their career with the company she will have charge of all arrangements for their welfare. In order to secure women whose physique will be equal to the strain of car conducting, the candidates have to pass the tests imposed by the company's medical man. Directly the company engages them for a week on probation the women come under the supervision of the welfare advisor, who gives lectures on health matters, to impress upon them the need for warm clothing, neatness of attire, and the fact that strong, low-heeled boots must be worn. During the nine hours' work per day times are given for meals and rest, amounting in the aggregate to an hour or an hour and a half, according to the duties, and rest-rooms are provided at all relief points and also at the depots. At these places the girls rest and eat their meals in comfort. Additions will be made to this scheme as soon as such arrangements are seen to be necessary by the advisor and the manager. Mr. Challenger is to be congratulated upon the completeness of the manner in which he has taken advantage of the progress that has been made in welfare work since most of the other tramway undertakings adopted women conductors. In those days tramway managers had to rely upon the help of their wives and of the wives of inspectors, assistance which was cheerfully given as a contribution to the national cause.

In reference to welfare work in Leeds as a new aid to productivity of output, the *Yorkshire Post* recently observed that "the Leeds Corporation tramways have now hundreds of women and girl conductors, and for their comfort special and separate accommodation has been provided at the various depots. Half-way through their duty they are relieved for half an hour (this practice, by the way, existed before), and since they have, of necessity, to leave home very early in the morning or return late at night, their discomfort has been relieved somewhat by a new privilege. Special cars are run between the depots and points near to the centre of the city to collect the women conductors (and, properly, the men drivers too) in the morning and return the late workers at night."

DISTRICT RAILWAYMEN AND THE WOUNDED.

Being in enjoyment of what is probably the most extensive example of welfare work in the Metropolis, it is not surprising to find that the employees of the District Electric Railway are alive to the importance of rendering aid to deserving causes. Their noble club premises, adjoining the station at Hammersmith and the garage of the London General Omnibus Company, were erected by the company in 1914, and it is in keeping with the interest that Sir Albert Stanley, the late managing director (now President of the Board of Trade) has manifested in the affairs of the staff and employees of the London Traffic Group, to find that the men named the buildings the "Albert Stanley" Institute. Apart from the cost of the caretaker, the employees are responsible for the maintenance of the Institute, but they have one or two ways of self-aid when they desire to benefit other institutions. Recently they invited their friends to three dances, and from the proceeds sufficient money was obtained to entertain 110 wounded soldiers from the hospitals in Hammersmith to a tea and concert. The visitors found plenty to occupy attention in the various departments of the Institute, and during the repast they were enlivened by the excellent orchestra of the Institute, conducted by Mr. J. Ryman. In the provision of the tea a number of local business establishments contributed gifts, while talented artistes supplied a high-class programme. The proceedings were presided over by Lieutenant F. T. Chapman, who, like some of the men in the room, has to use a crutch. Yet he is still serving the country during his convalescence by acting as military representative at the Hounslow Tribunal. Before the war Mr. Chapman was assistant to the chief engineer of the District Railway. Among the workers to whom credit is due for the success of the proceedings were Messrs. W. S. Every, H. G. Jeffs, A. J. Dalley, G. J. Cashman, C. Thurston, W. Hilton, G. Clarke, and G. Garrad. Wives and daughters of the members were indefatigable in waiting upon the guests at the tea.

Value of a Motor Car for Tramway Managers.—Oldham Tramways Committee have decided to recommend to the Council that a motor car be provided for the use of the manager and officials of the tramways department, the manager suggesting that the car should be a four-seater, capable when necessary of conveying workmen and materials. The matter arose out of Mr. P. Priestly's report on delay in snow clearance. Councillor Stanbury observed that a motor car for the department would save many a sovereign. Mr. Priestly remarked that all he had to depend upon for getting about to superintend the routes was a parcels van. If a runabout motor car was provided, the cost of it would be saved in a twelve-month in receipts that would be gained by better supervision, traffic, etc.

Colonial Tramways and Excess Profit Duty.—The Auckland (N.Z.) Tramways Company recently made application under the Finance (No. 2) Act, 1915, to the Commissioners of Inland Revenue for an increase of the statutory percentage of profit before the excess profits tax on their tramways becomes payable. The Board of Referees have decided that as from the commencement of the Act the statutory percentage shall be increased to 7½ per cent. in the case of a trade or business carried on or owned by a company or other body corporate, and to 8½ per cent. in the case of any other trade or business.

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EDINBURGH CABLE TRAMWAYS.

ELECTRIFICATION POSTPONED INDEFINITELY.

The Corporation of Edinburgh have received an intimation from the Ministry of Munitions that they cannot consent to steps being taken towards the electrification of the cable tramways or the provision of any new rolling stock, in readiness for the expiration of the company's lease on June 30, 1919. In view of this decision the Tramways Committee on December 27 resolved to recommend the Corporation to accept the offer by the company to sell the rolling stock, cables, and other plant to the Corporation at the expiry of the lease in June, 1919. The price to be paid by the Corporation on the transfer of the stock and effects is £50,000 for the rolling stock, consisting of not less than 200 cable cars, four electric cars, and 14 single spare cable trucks at present belonging to the company, together with a sum representing the value of other stock and effects at the date of the transfer. This sum to be fixed by a valuator agreed upon mutually.

This recommendation, if agreed to by the Council and carried into effect, will remove a difficulty which has arisen between the Corporation and the company in regard to the latter carrying out their obligations under the lease. The Corporation some time ago resolved to insist on the provisions in the lease regarding upkeep being carried into effect, and the question was in process of being submitted to the arbitrament of Sir Alexander Kennedy, the arbiter named in the original lease.

The company have now agreed to execute such works on the rails and roadway as are required in order to put the system into good tenantable and working order. On the expiry of the lease the rails and roadway over the system are to be fit and capable to carry on the efficient working of the tramways on the present cable system for a period of not less than six years after the expiry of the lease, with the exception of the acute curves at the junctions. All that is required with regard to the latter is that on the expiry of the lease they should be left in good working order and condition to the satisfaction of Sir Alexander Kennedy. The company also agreed to maintain all buildings, machinery, fittings, and appliances in good working order. In the event of the arbiter deciding that the rails and roadways prior to the expiry of the lease are in a condition to comply with the special standard and test set up, and that the buildings, etc., have been maintained in good working order, the company are to be freed from their whole obligations as regards maintenance during the lease. If, on the other hand, the arbiter decides that these undertakings have not been adequately met, the company are to pay to the Corporation a sum fixed by the arbiter.

The Tramways Committee have appointed a sub-committee to communicate with the Admiralty and any others concerned, with a view to ascertaining whether there is present or prospective need for further transport facilities between Edinburgh and Queensferry and Rosyth, and, if so, what these facilities should be, and what assistance may be available to the Corporation in the event of their resolving to provide them.

COMPARATIVE WORKING COSTS OF OMNIBUS AND TRAMWAY.

Under the auspices of the various merchants' associations of Edinburgh, Sir John H. A. Macdonald, K.C.B., recently gave an address entitled "Public Street Conveyancing To-day." While affirming that the citizens would rejoice to see the cable tramway cleared away, he said that it was not the best form of tramway conveyance that was the question, but what was the best use of the whole roadway in the interests of all classes of traffic, and the maintenance of the city. Within six years of the introduction of motor omnibuses in London 7,400 omnibuses were in operation, and were earning substantial dividends, while the London County Council presented a deficit in their tramway system of from £70,000 to £80,000 a year, and that was the case at present. To-day in London the mileage served by omnibuses was 456, while the tramway mileage was only 330, and that indicated how the trend of public favour was towards free moving vehicles. Eastbourne had refused to lay down tramway rails; in Oxford rails had been taken up and an omnibus service substituted; and Brighton had an omnibus service running east and west. Such facts as these were worth a thousand opinions of experts. Was this a time to embark upon a scheme on which half a million of capital would have to be sunk if by any reasonable means it could be avoided? Was it reasonable that such sums should be laid out if a service could be provided similar to what had proved satisfactory elsewhere, with outlay for vehicles alone? The success of the company that had for years run omnibuses from the centre of Edinburgh to the east and west and far into the country, and the phenomenal success of the London General Omnibus Company, were surely sufficient ground for holding that public enterprise would supply what was wanted, saving the city from being burdened with heavy debt. The placing of standards, brackets, and wires in Princes Street, the Mound, and the North Bridge would be most disfiguring.

A discussion ensued, in the course of which Mr. C. W. Shepherd, formerly manager of the tramway company, said the London omnibuses enjoyed a monopoly. The London public preferred the omnibus because it ran into the heart of the city. Central London could not be compared with any other place. It was so congested with other traffic that there was no room to put rails down. On the question of working expenses he said the cost per mile, including the cost of rails, for an electric tramcar was 5d. to 5½d., and, taking the pre-war price of petrol, the cost of running motor vehicles was a fraction under 10d. per mile.

Sir J. H. A. Macdonald, replying to the discussion, said that the London G.O.C. were running a big motor omnibus system quite as well as any tramways that existed. As to the mud nuisance from omnibuses in Edinburgh, the cure was to have no mud upon the streets, and that was for the municipality. The reason why the shop windows were bespattered with mud was because the omnibuses were obliged to run at the edge of the pavement through the tramways being in the middle of the street.

DIFFICULTIES OVERCOME AT NEWCASTLE.

An example of the means whereby public co-operation can be secured is afforded by a report presented to Newcastle Tramways Committee by Mr. Ernest Hatton. Mr. Hatton's report was written in reply to complaints alleging inadequate and irregular services, one of the complainers being the Gosforth Council. Mr. Hatton's observations gain their greatest effect because they are simply a plain statement of the difficulties encountered. These have had their counterpart in every tramway centre of this country, but there is no gainsaying the fact that among the great arsenal and shipbuilding works of the Tyne they have been more pronounced than elsewhere because of the extraordinary increase in the traffic. Whereas before the war there were 134 cars, including 96 workmen's, in service, the total is now 170, the whole of which are engaged in transporting workers. To cope adequately with the evening workmen's service another 40 cars and the necessary increased number of employees would be requisite. Completely as Mr. Hatton's report refutes any charge of slackness on the part of the tramways authority, it makes no attempt to do justice to the exertions of their two chief workers, viz., the general manager himself and Councillor Mayne, the indefatigable chairman of the committee. Ably supported by his fellow officers, Mr. Hatton has met the unique conditions of the past two and a half years by a resource that has found vent in introducing trailers and using the front platform as a means of exit, in order to secure more rapid working. Mr. Hatton's report states that for months past the undertaking has possessed none of the essential features for the maintenance of a regular service, and that it has done so well should be the surprise of everybody who gives it a moment's consideration. Many of the interruptions in the service were due to slight defects in the delicate parts of the electrical equipment of the cars, broken life guards, collisions with other cars due to inexperienced motormen, excessive loading, particularly between 4.30 and 6.30 p.m., and lack of street lighting. Within a few days of the outbreak of the war more than 100 men were called up, and yet, by re-arrangement of duties and considerable overtime being worked by the staff, not a single car was withdrawn. Immediate steps were taken to train other men, and in all, since that date 696 new motormen and auxiliary motormen have been trained, together with 201 youths, and, in addition, 528 women to fill the places of those joining the forces. The only disquieting portion of the report is contained in the reference to the reduction in the car maintenance staff. Except on a very limited scale no general overhauling of the cars has taken place since the war commenced, and when this general overhauling can be resumed, the general manager is unable to say at present.

INCREASED FARES ADOPTED AT LEICESTER.

In order to meet the additional expenditure during the year 1917, Leicester Tramways Committee recommend that the fare for a full journey on all routes be increased from 1d. to 1½d., with a penny stage on each route, and also to increase the fare for children to a penny. Alderman Flint, in moving the adoption of the recommendation at the Council's meeting on January 2, said that in 1913 traffic expenses were £54,257, and in 1916, £66,000; general expenses, £10,301, against £12,615; repairs and maintenance, £21,500, against £27,000; power expenses, £16,600, against £22,000; income-tax, £2,122, against £7,484; war allowances, nil, against £13,000. Totalled up, that made the 1913 expenses £104,946, and in 1916 £148,000. He did not anticipate a deficit on the 1916 accounts, but the balance would be a very small one, and they knew the expenses in 1917 would exceed the income unless they took steps to prevent it. An amendment calling for a detailed statement of the expenditure and the penny stages was defeated by 22 votes to 13. A further amendment for reconsideration of the increase in the children's fare was lost, and the report was adopted.

German Prisoners to Drive Farm Tractors. In connection with the scheme of the new President of the Board of Agriculture to use German prisoners of war and interned aliens for work on farms, a number of the men are being trained to drive motor ploughs and tractors.

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ELECTRIC VEHICLE COMMITTEE.

A meeting of the Electric Vehicle Committee was held in London recently, when Mr. E. S. Shrapnell-Smith, the vice-chairman, presiding. Mr. J. A. Priestley, having been elected by the Institute of Cleansing Superintendents as their representative upon the committee, took his seat for the first time.

A Hint to Chassis and Body Builders.

Mr. A. Harrison, borough engineer of Southwark, attended by invitation in order to discuss matters concerning the utilisation of electric vehicles for municipal purposes. Mr. Harrison explained the reasons why he had reported recently against the use of electric vehicles for certain work for which he proposed using motor traction. He was not unfavourable to the principle of the electric vehicle, and said that the reason why he had reported against it was really owing to their being no design of electric vehicle on the market which complied with an essential requirement for the particular work, viz., that the loading rail of the body should not be higher than 4 ft. 6 in. above road level. As far as Mr. Harrison was aware, there was no design of electric vehicle on the market which complied with this requirement. He expressed the hope that designers would, in the near future, be able to produce a vehicle specially adapted for the particular purpose he had in view, i.e., the quick and easy removal of street sweepings from the depots or stands in the streets, and the collection of house refuse. Mr. Harrison was heartily thanked for attending.

Charging Facilities.

In connection with the provision of charging facilities on the route London to Birmingham, correspondence was read from the Electric Supply Department of Coventry, setting forth that they were unable to give any facilities for charging, and from the Northampton Electric Light and Power Company promising to afford every possible facility for charging vehicles and stating that when the amount of business warrants it they will consider putting down a proper charging plant. They have decided to adopt the E.V.C. standard tariff.

The secretary reported that inquiry sheets as to charging facilities had been sent round to electric supply undertakings in connection with the list to be published shortly in the C.M.U.A. Handbook.

Miscellaneous Items.

It was decided to invite the Institute of Automobile Engineers and the British Rubber Tyre Manufacturers' Association to nominate a representative upon the committee. The official designation of the committee in future will be the Electric Vehicle Committee of Great Britain, formed under the auspices of the Incorporated Municipal Electrical Association. A communication was received from the Anderson Electric Car Company, of Detroit, stating that they were arranging to fit the E.V.C. standard plug to all electric vehicles exported to Great Britain and France. It was decided to recommend to the Accumulator Section of the B.E.A.M.A. that in the case of lead plate batteries on electric vehicles the upper and lower limits of Sp. G. should be clearly marked on the battery. It is suggested that this should be either in the form of a large plate with raised letters and figures attached to the battery box, or, as an alternative, that the figures should be moulded on the ebonite covers of the cells.

INSPECTION OF COMMERCIAL MOTORS.

The eleventh annual inspection of commercial motors and examinations of drivers, organised by the Commercial Motor Users' Association with the object of encouraging drivers by means of money prizes and other awards to take a personal interest in the driving and condition of their vehicles, and to run them without accident, will take place in London during May, 1917; but the parade of vehicles will not be held, owing to the difficulty of sparing vehicles from service. Prizes will be awarded to drivers for results obtained in practical, written, and oral examinations, coupled with inspection of their vehicles under running conditions. In this way it is hoped to carry on the educational work among drivers, which has been one of the aims of the Association since its formation in 1903. A new and advanced class of examination has been instituted, for which only the chief prize winners in previous examinations are eligible. The inspecting engineer will visit each garage before the examinations, and his reports on these visits, together with the marks obtained by the drivers in the examinations, will be recorded by the committee, and the following awards based thereon:

Class I. Championship Prizes (Practical and Written).—Steam Section—Prizes, £10 and £5; Petrol Section—Prizes, £10 and £5; together with medals or badges and certificates.

Class II. Prizes (Written Examination).—Prizes, £5, £3, £2, and ten prizes of £1 in each section—petrol, steam, and electric.

Class II. Prizes (Oral Examination).—Amounting to about £50 in total value, sub-divided into cash prizes of £2, £1, and 10s. each.

Particulars and entry forms may be obtained from Mr. F. G. Bristow, secretary, Commercial Motor Users' Association, 83, Pall Mall, London, S.W.

THE KARKOFF (RUSSIA) TRAMWAY SYSTEM.

The town of Karkoff owns a system of town tramways constructed by itself of 19 versts in length. The whole system radiates from one centre—Pavloff Place—and reaches the boundaries of the town by five routes. Each route has an arrival and departure connection in Pavloff Place, the fare being 5 copecks (5 farthings). From January, 1913, transfer tickets have been in operation. Two half sections cost 5 copecks, and three half sections 7 copecks. Notwithstanding the facilities thus offered, the public is inappreciative and is only taking to them gradually. Scholars' tickets have increased wonderfully, and from 3,000 to 10,000 such tickets are issued per day at Pavloff Place stations. In the mornings the most of the traffic is inwards—to the market; in the evenings outwards; but during the day it is about equal each way. Besides the day service, a night and early morning services were introduced in 1913. Both these services are increasing very rapidly. The total income of the town tramway services since the lines were opened in June, 1906, to January, 1914, was 2,920,580 roubles; the income rose from 115,307 roubles in 1907, the first complete year, to 544,941 roubles, 745,498 roubles, and 914,639 roubles in 1911, 1912, and 1913 respectively.

In 1913, there were 3,230,807 car-versts run and 17,704,886 passengers carried. The electrical power consumed was 3,505,406 KW. at a cost of 145,474 roubles, or 1·08 KW. for 4·5 copecks per car-verst (1,166 yards). This includes part of the street lighting on the tramway routes, car lighting, and power.

The employees number 797, including management, car staff, workshop employees, and labourers. The cost of the concern (per the 1913 balance sheet) is 3,103,385 roubles. In August twelve new trailers were added to the stock, costing 40,272 roubles.

The gauge of the Karkoff tramways is one metre. Various sections having been constructed at different times; these vary materially in their respective foundations, and there are great differences in the types of rails used. At present there are as many as seven different kinds of rails in use on the system. These differences in bed, rails, and points necessarily affect the maintenance of the line and movable parts of the cars. Part of the line has already had to be renewed and laid on sleepers. Other parts rest on the natural soil. The curves are not made with grooved rails of special type, but with common Vignole and counter rails. Another very serious defect in the line is that not one of the routes is double-tracked throughout its whole length. This causes a loss in time to the passengers and money to the town treasury. Most of these single line sections could be easily made double as far as technicalities go. The difficulty is want of cash. Still, one section—the "Panasovsky"—has been changed to double track to the obvious advantage of the working.

At the moment there are 124 cars belonging to the Karkoff tramway establishment. Of these 96 are motor cars and 28 trailers. The differences in type referred to above are seen also here. The cars were built by four different establishments on different designs, and their equipment, both electric and brake (vacuum), is in various forms. The power of the motors therefore differs, and varies between 23 H.P. and 41·7 H.P. There are some of 33·5, 36, 40, and 41 H.P. The vacuum brakes were fitted by two houses. This is also an inconvenience, for many parts do not correspond. The maintenance of the vacuum brake equipment is very costly. Each car besides is supplied with two brakes—ordinary hand and electric.

The motor cars obtain their current from aerial conductors, which take theirs from ten feeding points. Underground feeders are used. The considerable distance of some lines from the central station results in some loss in pressure, which is seriously felt when the lines are busiest. The varying pressures are expressed in the speed of the cars with consequent irregularity in the service, shown in the intervals between the cars. This can only be corrected by the construction of sub-stations at suitable points.

MOTORS DRIVEN BY WOMEN.

On account of the difficulty of securing men, the London County Council's ambulance station at Herbrand Street, Bloomsbury, together with the motor ambulance, is staffed entirely by women.

Half a dozen women began duty as drivers of the 1-ton vans used for the conveyance of the mail bags between the London sorting offices and the railway termini on November 27. They started duty with the 11 p.m. night shift. The women are members of the Women's Volunteer Reserve, and were trained at their garage in South Kensington and in the streets on a mail van placed at their disposal by the contractors. In a week or two they will be placed in charge of 2-ton vehicles, and if the experiment proves successful as many women will be employed as the Reserve can supply. They are paid 35s. a week, and a bonus varying from 3s. to 12s. 6d. The men whom they supplant are required by the Army, and the same firm of contractors have asked the Women's Volunteer Reserve to provide women to take the place of men who are engaged in looking after 700 horses.

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LOCAL AUTHORITIES AND INCOME TAX.*

To anyone who is not a lawyer and something of an accountant the whole body of income-tax law and procedure is a labyrinth or a morass, according to the point of view. It is indeed something of a scandal that successive Governments of this country should have failed to bring about a consolidation and simplifying of the whole scheme. They have admitted the need for such action, but instead of carrying it out they have gone on adding to the complication by successive Finance Acts containing both additional provisions and also amendments of the numerous Acts dealing with the subject which have been passed since the day—some will say the evil day—when income-tax was first introduced. Since the present war began the process of further complicating the labyrinth or deepening the morass has been accelerated.

These remarks are prompted by the fact that it takes a book of 248 pages to expound the law and practice of income-tax only so far as local authorities are concerned. Nor is the present book one of the padded-out kind; it is concise and brief to such a degree that the novice in the subject may desire further explanations. Messrs. Whiteley and Whittingham, experts in the subject, have done their work well, and their book should be of great value to everyone engaged on the financial side of municipal undertakings. The authors have dug out of the mass all that concerns local authorities in connection with income-tax, and presented a clear, continuous exposition. Incidentally, of course, main principles have had to be expounded. Thus the man who desires information on any point as affecting municipalities can readily get it here, instead of having to explore the more ponderous works which deal with the whole body of income-tax law. As the authors themselves say, there is probably no phase of municipal accountancy on which there is so much misunderstanding, and the necessity for a simple handbook has become very pressing.

In this journal the only undertakings of local authorities with which we are directly concerned are tramways, but it may be mentioned that the earlier part of the book deals with the various schedules of assessment, and gives a historical sketch of the prolonged struggles between local authorities and the Inland Revenue Department. Some clear decisions were in past years ultimately attained by cases being appealed to the House of Lords. Sometimes the judgment went in favour of the local authorities and sometimes the inland revenue got the best of the fight. The Executive Council of the Institute of Municipal Treasurers and Accountants have in recent times carried on negotiations with the Inland Revenue Department, and this has had the result of codifying the rules on which the assessments of the undertakings of local authorities are to be computed.

The question of allowance for depreciation when making assessments is one specially concerning tramways. There is no provision in the Income-tax Acts for an allowance against profits for the amount by which the cost of an asset is written down in order that a proper proportion of such cost may be debited to the revenue account in each of the years during which the asset may be expected to perform its functions, and the only allowance which may be legally claimed is of an amount representing the diminished value during the year in question by reason of wear and tear. Fortunately, however, the Inland Revenue Department have in many cases made a percentage allowance for depreciation. Neither do the Acts make any provision for obsolescence of plant, though in practice some allowance is made. For years, however, there was dissatisfaction owing to the want of uniformity of the practice in different districts Ultimately a scheme was agreed on between the Institute of Municipal Treasurers and Accountants and the associations of engineers and managers of the various classes of undertakings on the one hand and the Inland Revenue Department on the other. The scheme provides for the depreciation allowances for tramways and light railways, gas, water, and electricity undertakings. In regard to tramway permanent way, the scheme provides that the depreciation allowance shall be based on the average car mileage per mile of track per annum. Various rates of depreciation are allowed on other assets.

A large part of the book is taken up with detailed explanations of the method of assessing the various kinds of undertakings and properties of local authorities. Sample accounts are given showing all the items to be included and all the deductions to be made before arriving at the net assessable value both of properties and of profits. A very complete analysis is set out with regard to tramways, and further tables relate to calculating the amount of tramway profits available as "set-off" against the rating fund interest.

That the book is brought up to date is well shown by chapters on excess profits duty and controlled and certified establishments.

In their general conclusion the authors put forward a well-reasoned plea that much property of local authorities which is now assessed under Schedule A should not be assessed at all. A number of memoranda setting out various details form an appendix which completes the usefulness of the work.

* "Income Tax in Relation to Local Authorities," by F. Ogden Whiteley, city treasurer of Bradford, and William Whittingham, city treasurer's department, Bradford. 248 pp., 10s. 6d. Bradford: Wm. Byles & Sons, Ltd.

PAYING TOP DECK FARES ON ENTRY.

Mr. T. B. Goodyer, general manager, Croydon Corporation Tramways, has introduced payment of fares on the platform by top deck passengers at non-busy points, and the new system appears likely to be attended with success. In preparation for the innovation the following printed notice was exhibited in the cars:—"Paying Fares on Platforms.—Passengers upon joining cars at non-busy points and intending to travel on the outside, are respectfully requested to pay their fares on the platform." A handbill containing the appended announcement was also circulated:—"Notice to Passengers.—Pay as you enter. In order to assist the conductors in the collection of the fares, passengers joining the cars at non-busy points and intending to travel on the outside are requested to have their fares ready and hand same to the conductor on the platform. The conductor will immediately punch and hand to the passenger a ticket in the ordinary way, which should be retained until leaving the car, and, except in the case of a transfer ticket, placed in the box on the platform. The object of this request is to save the conductor a considerable number of journeys to the outside of a car to collect odd fares, and to prevent annoyance to passengers by frequently passing backwards and forwards. The management desire the assistance of the public in carrying out the foregoing, which should be in the interest of both passengers and employees." A card headed "Instructions to Inspectors and Conductors," stated *inter alia*:—"Such collection, however, is not to be made when it would cause delay in the running of the cars or a congestion of passengers on the platform. Whilst the object of the above is to save the conductor a considerable number of journeys to the outside of a car to collect odd fares, conductors must, as usual, check the tickets issued to the passengers, to see that none are travelling beyond the distance paid for, as their responsibility for the proper fares being collected, and corresponding tickets issued, is not varied in any way. Inspectors.—Please take particular notice as to the working of the above, and report in due course your observations hereon."

United Kingdom Manufacturers Represented in U.S.A.—H.M. Consul-General in New York (Mr. C. Clive Bayley) requests United Kingdom manufacturers who have branches, agents, or other representatives in the United States to forward to him the addresses of such representatives, as these will be of great assistance to him in dealing with the frequent inquiries he receives from American merchants.

Importation of Motor Cars.—The Electric Vehicle Committee has received a notification, dated December 29, from the Board of Trade Department of Import Restrictions stating that on and after December 29 it will not be possible to consider the granting of licences for the importation of motor cars or chassis, (1) if imported fully assembled, or (2) if imported in parts, unless permission to assemble has first been obtained from the Ministry of Munitions, and the application is accompanied by the licence so granted. The Board of Trade requests that immediate steps be taken to prevent the shipment of any further consignments of motor cars, chassis, and parts and accessories thereof.

Workmanship of the C.A.V. Lighting Sets.—When a Mex Motor Spirit lorry through skidding ran into the bridge at Bransford, near Worcester, at mid-day on November 27, and was precipitated into 16 feet of water, it was not until five in the evening of December 1 that it was got on to the bridge again. One of the engineers of the Bowring Petroleum Company, Limited, who was in charge of the operations, turned on the switch, and, much to his surprise, found the lighting set intact and in perfect working order, nor has it required any attention since, although it has remained in frequent use. This is a striking instance of the excellence of design and workmanship of the C.A.V. lighting set for heavy vehicles, and shows that the waterproof qualities and insulation of this famous system are practically perfect. Mr. Chas. A. Mott, the Birmingham and Midland manager for the Bowring Petroleum Company, vouches for the above remarkable facts.

The Road Service Battalion for France.—Mr. J. Johnson, borough surveyor of Rawtenstall, has been appointed captain in one of the companies now being formed by the county surveyor of Lancashire for service in France with the Road Service Battalion, Royal Engineers. Essex County Council have released all the surveyor's staff of military age for service with the battalion, and ten steam rollers have also been lent. The age limit for roadmen is fifty. The Council have asked the War Office to arrange for the employment of German prisoners of war in repairing the Essex main roads. Mr. R. H. Clements, deputy borough surveyor of Brighton, has been granted leave of absence to serve with the battalion, and the Works Committee of the Corporation propose to pay him such a sum as will bring his annual income up to 25 per cent. in excess of his present salary of £350. Mr. A. E. Prescott, borough surveyor of Eastbourne, has been appointed major in the corps.

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THE LATE MR. A. J. IRELAND.

A Pioneer of Electrical Industry.

We record with deep regret the death of Mr. Arthur James Ireland, manager of the supply department and branch offices of the British Thomson-Houston Company, Limited of Rugby. The sudden death of Mr. Ireland has come as a shock to his many business acquaintances in the electrical industry. He attended business in the usual way until Saturday, December 16, when, feeling slightly unwell, he decided to remain indoors for a few days, anticipating his illness to be merely of a transitory nature. On December 20 his physician diagnosed his trouble as due to gastric influenza, but as it did not lend itself readily to treatment, a specialist was called in for consultation on December 22. After examining the patient, he decided that an operation must be performed immediately, and this was done at 12.45 p.m. on December 22. The patient never recovered consciousness, and died at 3.15 the same day. It was the nature of the man to cheer up his family until the last moment, and as he was of unusually strong constitution, it was hoped that this would assist him to pull through successfully.

Mr. Ireland was born in Northampton 57 years ago. In 1879 he went to America, and subsequently joined the American Brush Company, of Akron, Ohio. He installed a number of "Brush" arc lamps in various parts of the West and in Texas, and as this

Mr. A. J. Ireland.

was in the early days of electric lighting his experience in the Western States were not only varied but often highly exciting.

Leaving the Brush Company he became associated with the Thomson-Houston Company, of Lynn, Massachusetts, and when they started to introduce their lighting system abroad, Mr. Ireland was appointed European expert to the Thomson-Houston International Company, who were engaged in carrying out various important contracts for arc lighting plant on the continent. It was while acting as their representative at Turin that he was summoned to England in 1885 to carry out work for Messrs. Laing, Wharton and Down, who had acquired the patent rights of the Thomson-Houston system in the United Kingdom. He was retained permanently on the staff of Messrs. Laing, Wharton and Down, acting as their chief engineer in connection with the installation of arc lighting systems at various places, including those at the American Exhibition at Earl's Court in 1887 and at the Italian Exhibition in 1888. Mr. Ireland took an active interest in the pioneer installations of the Thomson-Houston arc lighting at Taunton, Bath, Bristol, and other centres in the west of England, and had charge of the work of providing the grounds and buildings of the Military Exhibition at Chelsea with electric light. He also carried out some of the early work at the stations and goods yards of the Midland Railway Company at St. Pancras, Leeds, Bradford, and Derby. In addition to the above he was responsible for some of the early central station plant put down, such as at Weybridge, Fareham, etc.

In 1890 the contract for lighting the eastern portion of the city of London was awarded to the Laing, Wharton and Down Construction Syndicate, and Mr. Ireland had charge of all this work, including the erection of a temporary generating station at Wool Quay. Later on he supervised the erection of the first portion of the equipment of the main power house at Bankside, which was designed to furnish power to the whole of the City of London. The complete installation of street arc lighting throughout the eastern part of the city, and the extensive system of underground mains laid down in that area, also came under his control, as well as the erection of numerous sub-stations designed to supply private consumers.

In 1894 the Laing, Wharton and Down Syndicate was turned into the British Thomson-Houston Company, Limited, and while acting as chief engineer for the latter, Mr. Ireland carried out important central station work in different parts of the kingdom, including the electrification of tramways in Dublin and elsewhere.

In 1896 the supply business of the British Thomson-Houston Company, Limited (the successor of the two companies mentioned above) became so extensive that Mr. Ireland was given entire charge of this work, becoming later also the manager of the various branch offices of the company. Since then he has continued to control this department of the company's business with uniform success.

Mr. Ireland was widely known and respected in electrical and manufacturing circles in the United Kingdom. He was a man of strong character, and all those with whom he came in contact were struck by his honesty of purpose and great sincerity. He was in every sense a fine Englishman, and had the ability to get the best out of all those who worked under him, while still maintaining the most friendly relations with them. Not only his staff, but everyone with whom he had business relations, knew that his word could be absolutely depended upon.

He was buried on December 28 at Barnes New Cemetery, Upper Richmond Road, Sheen. He leaves a widow, son, and daughter.

TRAFFIC DIVERTED TO TRAMWAYS BY INCREASED RAILWAY FARES.

Now that since January 1 a great deal of traffic has been thrown upon the tramways in various parts of the country owing to the action of the Board of Trade in raising fares 50 per cent., the managers of already heavily burdened tramways should not lose sight of the importance of appealing to the public to give the undertakings the utmost consideration. Frank action in this direction has already been taken at Bradford and Newcastle.

Energetic Policy at Bradford.

In an interview, Mr. C. J. Spencer, general manager, said:—"The staff and the public have faced the difficulties hitherto very well. We now want them to do a little bit more, if they will. Now that the railway facilities have been much reduced, a new accession of traffic will be diverted to the tramcars. This morning (January 2), for instance, we have had a marked increase of traffic between Leeds and Bradford. The problem will be how to deal with this new burden on an already overburdened system. We see no other way of doing it at the moment than distributing what may be called 'the rush' traffic somewhat over the quieter periods. What I have suggested to the Tramways Committee is that an effort should be made to persuade employers to agree to varying the times at which they open and close their offices and warehouses for business and make corresponding variations in the meal hours. This would in some measure disperse the concentrations we get at the queues and along the routes at these three periods of the day. If, too, the women folk of the city will make it a practice to do their shopping during the hours when the pressure on the cars is not so heavy, they will assist us a good deal." The Lord Mayor has been asked to call a conference of business men to discuss the Tramway Committee's suggestions.

Manchester and Salford.

Mr. J. M. McElroy, general manager, Manchester Corporation Tramways, has stated that he feared the only provision that could be made in that city would be between the morning and evening rush periods.

Alderman Linsley, chairman of Salford Corporation Tramways, states that his undertaking had not enough drivers, and a large number of cars were standing idle. The only way out of the dilemma was the employment of women. It had been suggested that there should be a conference between the Manchester and Salford tramway authorities with a view to adopting ameliorating schemes. Alderman Linsley expressed the opinion the time had come for revising the fares. Another point, he said, to be considered was the use of trailer cars.

Mr. J. Dalrymple took immediate steps at Glasgow to appeal to employers to organise in order to prevent overcrowding. Two years ago he adopted the same idea. In the meantime the traffic has grown so that there is no room in the streets to put on any more cars. A census of the traffic has also been taken with a view to ascertaining the points of greatest congestion.

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DIFFICULTY OF MAINTAINING SERVICES.

Although tramway authorities will be united in doing their utmost to comply with the increased demands imposed by the revised age for temporary exemption of tramcar and omnibus dr vers, they will be placed in a very difficult position. Judging by the appeals that managers have been making during the past three months to retain the services of men up to 35 years of age, they are likely to continue to allow the tribunals to take the responsibility of depriving them of the services of unmarried men up to 41 years of age and of married men of 25 years. As the notice indicates, the latter age is to be raised early this year, but in practice married men of that age were already either being taken for the army or given a period of exemption which expired on January 1. The prospects of a further renewal are not encouraging on routes where cars do not serve munition workers.

Already a number of managers have informed the tribunals that the loss of the motormen for whom they appealed would necessitate the reduction of the service, and in the case of Brighton the military representative—a former mayor—replied that the public were willing to accept it. While in a number of places such a course could be adopted, there are numerous towns where any interference with the traffic would be at the expense of war industries, in which the workers are employed in two shifts, entailing a doubling of the demand upon the tramway service, to say nothing of the increased traffic due to the activity of trades concerned in the all-important work of maintaining the national exports. In the substitution scheme described on another page of this issue some relief may be found.

Little if any assistance in tramway work is being secured from discharged soldiers, all of these men who have any approach to physical fitness having been recalled to the colours. In not a few towns it is becoming increasingly difficult to maintain the numbers of women who are acting as conductors. Many of those who are married have found that their home duties must receive more attention, and young girls are filling the vacancies on the cars. The increasing demands of the national munition factories must inevitably reduce the number of women available. In London the scarcity has become apparent, both on the tramways and the omnibuses.

Volunteer and Women Drivers.

An increasing number of tramway undertakings are finding it necessary to appeal to business and other men to act as voluntary drivers at the rush periods. Huddersfield is the latest instance, the step being taken in order to fill vacancies caused by motormen having been called up. The first departure of this kind was made early in last year by the Newcastle-on-Tyne Corporation Tramways in order to meet the demands of the heavy workmen's traffic. In that city there are also volunteer conductors. Birmingham, Bradford, Portsmouth, and Coventry are also places where auxiliary motormen are rendering useful service.

The suggestion of utilising women has been put forward by many of the tribunals, and the manager of the Ilford tramways had to inform the Essex County Tribunal that the metropolitan police would not issue licences. A definite request to the Home Office to over-rule the police has just been made by the Walthamstow Council. In this connection it is interesting to recall that it was the appeal of an East London Tramways Committee in September, 1915, that the Municipal Tramways Conference successfully took up with the Home Office the police refusal to allow women to act as conductors in the metropolitan district.

During the past few weeks Newcastle, Keighley, Nottingham and Leicester have begun the experiment of women drivers, but at Keighley they have been withdrawn on the ground of lack of strength. There are a dozen towns in which their work in that capacity has passed the experimental stage on suitable routes and cars. At Glasgow their services have been utilised as drivers for just over 12 months, and nearly 200 women are thus engaged in that city. In his New Year message to the Glasgow employees, Mr. J. Dalrymple, the general manager, appealed to every woman conductor to put her name down for the motor school. On January 1 women made their appearance as drivers on certain routes of the Paris Tramways. For some time they have been acting as drivers at Bordeaux, and a similar innovation is about to be made at Vienna.

Manufacture of Copper Wire Restricted.—The Minister of Munitions has issued an order prohibiting as from November 6 the manufacture of any copper wire or any cable containing copper, except for the purposes of any of the following contracts or orders for the time being in existence, namely :—

(1) A contract or order to which there shall have been allocated by the Priority Branch of the Ministry of Munitions a reference number and priority classification within Classes "A" or "B" of circular L. 33 as to control of output issued by the Minister of Munitions on March 31, 1916, or

(2) A contract or order with and bearing the reference number and identification letters of any of the following Departments, namely :—The Admiralty, the War Office, the Ministry of Munitions, and the Post Office.

WELLINGTON CORPORATION TRAMWAYS.

In his annual report to the Power Stations and Tramways Committee of the Wellington (N.Z.) City Council, Mr. W. H. Morton, general manager, states that the financial position is in every respect satisfactory. The great increase in the cost of repairs and maintenance and the construction of new works, owing to war conditions, will, however, require the observance of the strictest economy, and only such works will be carried out as may be necessary to cope with the traffic. A comparison of the financial results for the past two years is given in the following summary :—

	1915–16.	1914–15.	Inc. or Dec.
Revenue	£187,864	£167,331	+ £20,533
Working expenses	£118,817	£111,138	+ £7,679
Capital charges	£41,927	£40,824	+ £1,103
Total expenses	£160,744	£151,962	+ £8,782
Net surplus	£27,120	£15,369	+ £11,751
Percentage of working expenses to revenue... ...	63·25	66·42	- 3·17
Percentage of net surplus to capital outlay	3·79	2·29	+ 1·50

Power Supply Revenue and Expenditure.

	1915–16.	1914–15.	Inc. or Dec.
Revenue	£12,763	£11,638	+ £1,125
Working expenses	£6,098	£5,909	+ £189
Capital charges	£5,359	£5,415	- £56
Total expenses	£11,457	£11,324	+ £133
Net surplus	£1,306	£314	+ £992
Percentage of working expenses to revenue... ...	47·78	50·77	- 2·99
Percentage of net surplus to capital outlay	2·89	·72	+ 2·17
Total revenue per car mile ...	16·19d.	15·92d.	+ ·27d.
Working expenses per car mile	10·24d.	10·57d.	- ·33d.
Capital charges per car mile	3·62d.	3·89d.	- ·27d.
Total expenses per car mile...	13·86d.	14·46d.	- ·60d.
Net surplus per car mile ...	2·33d.	1·46d.	+ ·87d.
Passengers carried (ordinary fares)	23,385,903	20,793,465	+ 2,592,438
Passengers carried (concession rates)	5,301,870	4,724,050	+ 577,820
Total passengers carried ...	28,687,773	25,517,515	+ 3,170,258
Average fare per passenger ...	1·44d.	1·44d.	—

Average fare per mile :—Ordinary cash fares, ·89d. ; concession tickets, ·60d. ; workers' tickets, ·44d. ; scholars' tickets, ·19d.

The amount to the credit of the depreciation and renewals fund now stands at £156,618. Of this amount £130,557 has been expended on new works. The accident fund, which was inaugurated in 1909, now stands at £10,689. The tramways, power supply, and public lighting sinking funds totalled £76,015 at March 31, 1916. Of this amount £5,293 has been applied in repayment of loans, £64,068 has been invested by the Commissioners, and the balance, £6,654, was available for investment at the commencement of the current year. The total capital expenditure is £760,224, of which £45,184 was for power supply and public lighting. Expenditure on new works during the past year amounted to £45,823. The rolling stock now numbers 107 passenger cars and five other vehicles, including two freight cars, one watering car, and two cars for dealing with breakdowns and track repairs. In consequence of the abnormal increase in traffic last year, Mr. Morton states that the number of cars has been found quite inadequate and it has been impossible to keep a sufficient margin of cars in the workshop for overhaul and repairs. It was hoped to build and equip ten large cars during the current year, but owing to the great difficulty in obtaining material and the shortage of skilled labour it is probable that these cars will not be available for traffic this year. A new special track-cleaning vehicle will, however, shortly be ready for service. A new car shed at Kilbirnie, which has been under construction since December last, will for the same reason probably not be ready for use until the end of the current year. This shed is being constructed in ferro-concrete and steel, and will have accommodation for 42 cars. The space available for extensions will enable the capacity to be increased to over 90 cars. The erection of extensive workshops for building and repairing cars at Kilbirnie, for which plans had been prepared, has been temporarily postponed. Meanwhile the work is being carried out at the Newtown car shed. The Babcock and Wilcox water tube boiler, the first to be obtained for the new power station, which was ordered last year, has been delivered and will completely fill the available space in the boiler house, which is already equipped with nine boilers of the Lancashire type. In view of the small margin of generating plant available for meeting emergencies, provision has been made in this year's estimates for the purchase of a 1,000-KW. mixed pressure geared turbine, which will enable the full capacity of the present stations to be utilised. There is, however, little prospect of this unit being delivered within this financial year, and in consequence the whole of the present sets have to be kept in continuous service with practically no margin in case of a breakdown. The power supply to private consumers continues to increase and 25 new consumers with motors aggregating

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521 H.P. were added during the past year, bringing the total number up to 285, using 4,058 H.P. Mr. Morton anticipates that the advent of the electric vehicle, which will undoubtedly take place when conditions again become normal, will create an additional demand for power. Additional feeders have been provided during the past year, and a heavy feeder is to be laid to Lambton Quay and also one to Brooklyn, which will be provided with a booster. The extension of the track along Waterloo Quay is proposed, if suitable arrangements can be made with the railway department, and if the necessary material can be obtained it is proposed during the current year to carry out a further duplication of the Island Bay line, as the length of single track on this line occasions much inconvenience in dealing with the heavy traffic. A large amount of repair work on the track has been carried out and check rails of special design have been introduced on many of the curves. It will shortly be necessary to renew the major portion of the special work at the principal junctions, and as soon as material is obtained a start will have to be made in renewing the whole of the track in Manners Street and Willis Street to Lambton station. This part of the track has been carrying the heaviest traffic of the system since the beginning of the service in June, 1904, and is now plainly showing the effects of wear. The outstanding feature in connection with the traffic during the year was the phenomenal increase in the number of passengers carried on all lines. This increase proved a severe tax on the service, on account of the shortage of cars already mentioned, and also owing to the loss of the services of a large number of trained men due to enlistment and other causes. Notwithstanding the difficulties experienced in obtaining suitable men, however, and the fact that about 80 per cent. of the conductors manning the cars were men of less than one year's service, the full service was maintained with comparatively few complaints from the public, who generally appear to have appreciated the disability under which the department was working. During the year 68 tramway employees, or 12 per cent. of the total staff, have been absent on active service, and in each case the Council has allowed the difference between the military pay and the amount which they were receiving in the service before enlistment. The total strength of the staff and employees at March 31, 1916, was 563, comprising 68 officers and 495 employees.

STOPPING PLACE INDICATORS.

TWO INVENTIONS IN THE LIVERPOOL DISTRICT.

An electro-magnetic route indicator has been devised by Mr. C. W. Mallins, general manager, Liverpool Corporation Tramways, for the purpose of overcoming the inconvenience caused to passengers at night when the conductors fail to announce the names of stopping-places. When the car approaches a stopping-place the cover of a cabinet in the saloon swings open and discloses the name of the street, at the same time a gramaphone appliance calls out the name. Simultaneously a bell rings to call the attention of passengers to the announcement. Mr. Mallins reports that the experiment has been entirely successful, and as fast as the electric parts of the appliance can be secured it will be placed in every car.

Thanks to the ingenuity of one of his assistants (Mr. W. L. Box), the general manager and engineer-in-chief of the Liverpool Overhead Railway Company (Mr. E. J. Neachell) has solved the problem of letting passengers on the company's Seaforth and Great Crosby Tramways know where they are in the blackness entailed by the restricted lighting. The idea consists of the application of the megaphone or telephonic horn. A mouthpiece is attached to the driver's dash stanchion, and connected by a solid tube to a horn fixed on the ceiling of the car. Drivers are instructed to call out through the tube the names of the principal stopping stations as they are approached. The advantage to passengers is obvious, since it is impossible for people to know their whereabouts when blinds are drawn, windows painted, and streets void of light.

SPON'S ELECTRICAL POCKET-BOOK.

The general scope of this useful handbook (London : E. and F. N. Spon, 6s. net) is well known. As the author, Mr. Walter Molesworth, says, it is not possible within the limits of a pocket-book to enter into questions of design and detail and to present such knowledge as comes within the province of the text-book. The information which is given, however, is comprehensive and varied, and it includes a great number of tables. In the main the heavier branches of electrical engineering are dealt with, the treatment under each heading being brief, as befits a reference book. In view of the ever-increasing adoption of metric weights and measures in all parts of the world, full metric conversion tables have been inserted. Perhaps to a greater degree than in some other electrical pocket-books space is given to general engineering data which every engineer, mechanical or electrical, requires. The book should be of value to engineers engaged on traction work, as a great deal of the space is devoted to electric railways and tramways and their equipment. Similarly, three-phase generation and transmission along with sub-station plant are largely dealt with. There is a copious index.

FINANCIAL REPORTS AND MEETINGS.

Millars' Timber and Trading Company.—The half-yearly dividend on the preference shares, due on January 1, will not be paid.

Brazilian Traction, Light and Power.—The board of this company have announced a quarterly dividend of 1½ per cent. on the preference shares.

Electric Construction Company.—The directors have declared an interim dividend at the rate of 7 per cent. per annum on the preference shares.

Birmingham District Power and Traction Company.—At special meetings of the shareholders the capital of this company has been reduced from £1,050,000 to £700,000.

British Electric Traction Company.—The directors have declared the dividend on the 6 per cent. cumulative participating preference stock for the half-year ended September 30.

Manila Electric Railroad and Lighting.—This company announce a dividend of 1¾d. per cent. (1·50 dols. per share) for the quarter to December 31, 1916, on the common stock.

Manx Electric Railway Company.—The accounts for the year ended September 30 show a loss of £735, in addition to £9,000 for debenture interest, and the adverse balance brought forward was increased to £19,171.

Yorkshire (West Riding) Electric Tramways Company, Limited.—A final dividend of 3 per cent., being at the rate of 6 per cent. per annum on account of the dividend accrued on the 6 per cent. preference shares, was paid on January 1, 1917.

Tucuman Tramways, Light and Power Company.—After providing for debenture interest, administration expenses, etc., the accounts for the year to June 30 show a profit of £7,306, thus reducing the debit balance of £42,516 brought in to £35,210.

United Electric Tramways of Monte Video.—An interim dividend will be paid on preference shares for half-year to September 30 at the rate of 6 per cent. per annum, less tax. No interim dividend has been declared on ordinary shares for the half-year.

Buenos Ayres Lacroze Tramways.—The sum of 728,157 dollars is available as the result of the past year's trading. Of this sum the board propose to place 5 per cent. to reserve and to allot 5 per cent. for directors' remuneration ; ½ per cent. is to go to the syndic and 625,000·00 dollars to the shareholders, leaving 35,483·40 dollars to be carried forward.

Buenos Ayres City and Suburban Railway.—The annual report of this company states that the construction of the line between Olivos and San Isidro has been finished, but the level crossing over the Central Argentine Railway Company at Olivos has not yet been built, and the line beyond that point has not been opened. Relations with the municipal and provincial authorities continue to be satisfactory.

East India Tramways.—For the year ended July 31 last the gross receipts were £17,104, and the working expenses £19,408, making net receipts £7,696. Four hundred pounds has been placed to reserve. There is a balance available for dividend of £7,400. The directors recommend a 5 per cent. dividend on the cumulative preference and ordinary shares, of which an interim dividend of 2½ per cent. was paid May 31 last, and 10 per cent. on the preferred shares, leaving £354 to be carried forward.

Remarkable Half-year at Glasgow.—During the first six months of the financial year of the Glasgow Corporation Tramways the total receipts were £623,046, as compared with £574,254 in the corresponding period of last year—an increase of £48,792. The number of passengers carried was 193,800,839, as compared with 179,590,102 an increase of 14,210,737. The weekly receipts are now about £23,347, an increase of £2,349 as compared with the corresponding weeks of last year, while the number of passengers is about 7,485,148, an increase of 711,000.

Stirling and Bridge of Allan Tramways Company.—At the annual meeting Mr. H. F. Brand (chairman) stated that owing to the extraordinary increase in all working expenses, and particularly in the cost of provender and litter, the year's working had resulted in a loss of £197. Comparing the receipts with the expenditure of 1914 they would show a handsome profit. They had tried to minimise the increased expenditure by increasing the fares, and the increase was not a serious one. The directors regretted to report the death of Mr. John Kinross, who had been an active member of the board for over 40 years.

Dublin United Tramways Company.—The directors have recommended, subject to final audit, the payment of a dividend at the rate of 6 per cent. per annum, less income-tax, for the half-year ended 31st December, 1916, on the preference shares of the company, and a final dividend at the rate of 5 per cent. per annum, less income-tax, for the half-year ended 31st December, 1916, on the ordinary shares, after setting aside £20,000 towards renewal of rails and £7,000 towards reserve and renewal fund, and carrying forward £13,359 to next account. This time last year the final dividend was the same, with £18,000 to renewals, £5,000 to reserve, and £11,045 forward.

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Cardiff Corporation Tramways.—The city treasurer has reported that for the year ended March 31 last the traffic receipts amounted to £140,875 17s. 5d., as against £138,672 2s. 7d. for the previous year, or an increase of £2,203 14s. 10d. The total income amounted to £167,793 19s. 10d., or £3,111 1s. 10d. more. The payments to reservists and recruits on service amounted to £5,326 16s. 11d., which directly contributed to a reduction in the surplus of income over expenditure for the year. From the surplus of £20,524 14s. 1d. a sum of £6,946 10s. had been transferred to the depreciation fund. The balance of the depreciation fund amounted to £70,606 7s. 6d., and a sum of £3,013 19s. 10d. was spent during the year on the reconstruction of the track. The net loan liability of the undertaking amounted to £445,296 13s. The amount paid off and set aside for redemption of debt represented 37·39 per cent. of the total liability, in addition to which there were substantial funds in hand for insurance, depreciation, etc. The total capital expenditure was £305,775, of which £7,585 was expended during the year.

Birkenhead Corporation Tramways.—Mr. C. Clarke, general manager, Birkenhead Corporation Tramways, in his report for the year ended March 31, 1916, states that the income was £72,820, or £4,212 higher than ever previously recorded. As compared with last year the increase was £7,035. The working expenses amounted to £38,833, a decrease of £634 as compared with the previous year, while the profit on working was £33,987, an increase of £7,669. Interest on capital, sinking fund, and income-tax required £23,417, leaving a balance of £10,570. Of this amount £4,000 has been paid to the relief of rates, £2,000 to the reserve fund, and £4,570 to the renewals fund. War allowances to dependents of employees on active service amounted to £1,589, and the war bonus to employees to £884. All wounded sailors and soldiers have been allowed free travelling on the cars. In August women were employed as cleaners, and in September as conductors, and their work has been satisfactory. Owing to the increased cost of supplies the Tramway and Electricity Committees mutually agreed to an increase in the price of energy from ·953d. to 1·053d. The average consumption per car-mile was 2·044 units. The percentage of working expenses to receipts was 53·32. The total revenue per car-mile averaged 14·84d., and the working expenses, including power, were 7·91d.

Isle of Thanet Electric Tramways and Lighting Company.—The report of the directors for the year ended September 30 shows a profit balance of £9,742, compared with £10,050 the previous year. The board state that the Isle of Thanet has passed through another year of severe depression. The gross receipts from the undertaking —£28,835—show a falling off from 1914-15 of £2,752 (and of £19,671 when compared with the last full pre-war year, i.e., September 20, 1913). It was possible, however, to effect a saving of £2,445 in working expenses, and the profit balance for the year is sufficient to cover all the interest charges and to leave a sum of £389 17s. to be carried forward to the next account. The tramway receipts have shown some increase since the end of the financial year, but the directors state that they must look forward to the termination of the war before they can expect a substantial improvement in the position of the undertaking. The accounts show a profit on the motor omnibus services of £515. From the sale of scrap material £1,025 was received. Allowances to dependents of staff serving with the colours amounted to £355, and £280 was spent on insurance against aerial bombardment. These items are included in the capital and liabilities account, which also includes the following items:—Third party insurance reserve, £5,000; permanent way reserve, £14,309; rolling stock reserve, £1,924.

British Columbia Electric Railway.—In the absence of Mr. Horne-Payne, the chairman, Mr. G. P. Norton presided at the annual meeting of this company on December 22, when a speech prepared by the chairman of the company was read. In it he stated that the gross income for the year ended June 30 last was only £258,000, as compared with £370,000 in the preceding year and £560,000 for 1913-14. These decreases were due to a reduction of 30 per cent. in the population owing to the voluntary enlistment in the army of the Empire, and to the continued unfair competition of jitney cars. This competition had been less acute than in the previous year, but these cars were still depriving the company of approximately 350,000 dollars a year. Every effort had been made to endeavour to secure that the jitney owners should be subject to similar control of service as the company, and that they should contribute to municipal revenue, but it had as yet been impossible to convince the authorities and the public of the folly of the preferential treatment to the rivals of a great enterprise, which had done so much for the Province. Concessions to the employees involved an increase of 100,000 dollars per annum in the cost of labour. During the four months of the current year there was an increase of over £30,000 in net earnings as compared with the corresponding period of last year. The directors hoped that this increase would continue, so as to enable them to meet the dividend on the 5 per cent. cumulative preference stock without having recourse to the reserve fund, as they have had to do this year, and perhaps leave a small surplus. In their report the directors stated that after setting aside for renewals £102,236, and for income-tax £10,000, and adding to capital amortisation fund £2,655, the net revenue for the year ended June 30 amounted to £134,964, making, with the balance brought forward and £70,000 transferred from the reserve fund, £211,630. Debenture interest and dividends on 5 per cent. preference stock absorbed £204,771, leaving £6,859 to carry forward.

Blackpool Corporation Tramways.—In his annual report, Mr. C. Furness, general manager, states that the gross profit of £35,026 was divided as follows:—Interest and sinking fund, £18,760; reserve fund, £3,275; permanent way renewal fund, £8,000; relief of rates, £5,000. The net profit constituted the third best in the history of the department. The receipts were £3,961 more than the previous year, though up to the end of September the increase only stood at £849. The winter months brought an approximate increase of £2,600. Appended is a statement compiled from the returns for the past three years:—

	1915-16.	1914-15.	1913-14.
Capital expenditure ...	£317,988	£316,005	£310,994
Amount outstanding ...	£313,888	£316,005	£310,994
Traffic revenue	£78,825	£75,344	£84,034
Total revenue	£80,066	£76,105	£84,797
Working expenses ...	£43,471	£44,527	£43,486
War allowances	£1,559	£323	—
Gross balance	£35,036	£31,255	£41,311
Net profit	£16,275	£13,736	£14,553
Passengers carried ...	14,585,851	13,624,514	14,289,802
Fare per passenger ...	1·30d.	1·32d.	1·41d.
Car-mileage	1,069,524	1,085,656	1,075,943
Units per car-mile ...	1·55	1·43	1·40
Power cost per car-mile ...	2·39d.	2·26d.	2·29d.
Traffic receipts per track mile	£4,504	£4,370	£4,524
Traffic receipts per car-mile	17·69d.	16·82d.	18·74d.
Expenses per car-mile ...	9·76d.	9·84d.	9·69d.
Ratio of working expenses	56·24	58·93	51·28
Total track mileage ...	21 m. 51 ch.	21 m. 51 ch.	21 m. 33 ch.
Number of cars in stock ...	84	84	78

DICK, KERR & CO. ACQUIRE THE UNITED ELECTRIC CAR CO.

Messrs. Dick, Kerr and Company have issued a circular to the shareholders in which they offer to acquire the preference and ordinary shares of the United Electric Car Company, Preston. A circular sent out by the directors of the latter company recommends the acceptance of the terms. For each preference share it is proposed to give one 6 per cent. cumulative preference share of £1 (fully paid) in Dick, Kerr and Company, the preference shares in Dick, Kerr and Company given in exchange to rank for the full six months' dividend payable on April 1, 1917, or, in the alternative, they will pay 20s. cash. For ordinary shares the price will be 15s. in cash for each ordinary share. The directors (other than Mr. Prestwich, who is vice-chairman of Dick, Kerr and Company) have agreed to transfer the shares held by them on the above terms. The directors (other than Mr. Prestwich) will retire from the board, and the shareholders will be invited to appoint a new board in their place, consisting of persons to be proposed by Dick, Kerr and Company, who have agreed to pay £3,000 to the directors retiring as compensation for loss of office. The United Electric Car Company was formed in 1898, and has a share capital of £250,000, of which sum £150,000 is in ordinary shares. For the past two years only the dividends were paid on the 6 per cent. preference shares, but the ordinary shares received 5 per cent. in 1911-12, 1912-13, and 1913-14. The purchase of the shares by Dick, Kerr and Company does not mean that the United Electric Car Company will cease to exist. It will continue to be a separate company, but will be controlled by Dick, Kerr and Company.

MELBOURNE TRAMWAYS AND OMNIBUS COMPANY.

The directors, in their report for the year ended June 30, 1916, state that the company's leases of the cable tramway lines expired on June 30. Under the provisions of an Act of the Victoria Parliament passed in December, 1915, replacing the Melbourne Tramways Trust by a Tramway Board, constituted in January last, to control the cable system, all the company's freeholds, rolling stock, and plant required to work the lines were vested in the board on July 1, 1916. The board at that time also took over the whole of the company's working staff. Under this Act the amount of compensation to be paid to the company is to be fixed by a Supreme Court judge, Mr. Justice Cussen, who has been appointed arbitrator by the Government. The award is to be given not later than January 1, 1917, and the final payment must be made within the following three months. The board is also to pay interest at the rate of 5 per cent. per annum from July 1, 1916, on the amount of the award. The profits of the company for the year amounted to £334,493, of which £312,000 has been paid in dividends and bonuses, leaving a balance of £32,493, thus increasing the amount brought forward from last year to £50,443, which has been carried to a special reserve account. The traffic receipts have increased by £74,151, and the number of

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passengers by 8,642,820. The paid up capital of the company is £400,000.

During the past year the directors continued to purchase outstanding debentures. The loss on realisation amounted to £6,328 18s. 2d., which has been provided out of the general reserve. To this reserve has been carried the usual allotment for renewals of the lines, and to it has been debited the amount spent. The final distribution will depend upon the valuation of the arbitrator of the assets taken over by the Tramway Board. The directors have distributed £10,709, in accordance with a resolution passed at the shareholders meeting in January last, to long service employees who have reached an age at which they could not hope to remain long at work.

The chairman of the board and managing director, Mr. F. B. Clapp, resigned in June on account of failing health, a position he had held since the inception of the company. The directors express their sense of Mr. Clapp's great abilities, his rare judgment and foresight, and his just dealings with the whole of the staff throughout his long control of the company's affairs. The directors also record with regret the death of one of their number, Mr. C. M. Puckle. The remaining directors are Mr. W. G. Sprigg, chairman, Mr. John Grice, and Mr. David Hunter. The secretary is Mr. H. A. Wilcox.

CONTRACTS AND ORDERS.

Hadfields Limited have a contract to supply twelve sets of manganese steel points to Sheffield Corporation Tramways.

Launceston Council, Tasmania, have placed a contract for 26 transformers with the General Electric Company, London.

Yarmouth Council have placed an order with the Yarmouth Stores, Limited, for overcoats for women conductors at 39s. 6d. each.

The British Thomson-Houston Company have received orders for switchgear from Newport, Walsall, and Wolverhampton Corporations.

Sheffield Electricity Committee have placed contracts for transformers with Ferranti, Limited, and the Brush Electrical Engineering Company.

Glasgow Tramways Committee have accepted the tender of W. T. Henley's Telegraph Works Company for the supply of rubber insulated cables.

Shepherd's Parging Block Company, Limited, have received a further order from Salford Corporation Tramways for a large quantity of parging blocks.

Melbourne Council have placed contracts for insulated cable with Messrs. Johnson and Phillips, Limited, and for bare copper cables with the British Insulated and Helsby Cables, Limited.

Newport Council have accepted the appended tenders :—British Westinghouse Electric and Manufacturing Company, Limited, Trafford Park, converting plant and accessories ; British Thomson-Houston Company, Rugby, switchgear.

Sheffield Tramways Committee have recommended the Corporation to accept the tender of the Brush Electrical Engineering Company, Limited, for the supply of 28 double-deck top-covered cars without electrical equipment, at £1,060 per car, plus 5 per cent. for contingencies. The Electricity Committee have placed contracts for 12 oil-break switches and 30 panels of sub-station switchgear with A. Reyrolle and Company, Limited.

Johannesburg Council have placed contracts for tramway supplies with Hadfields, Limited, Griffin Engineering Company, H. Davies and Company, H. M. Dowson, and Messrs. Rennert and Lenz. For the electricity department the following tenders have been accepted :—Cables, Telegraph Manufacturing Company, London ; eight transformers and spares, R. H. Gould and Company ; steam-driven boiler-feed pump, Messrs. Sturrock and Company, with turbine by Belliss and Morcom, Birmingham, and pump by Rees Roturbo Company, Wolverhampton.

Victorian Railway Commissioners have awarded the subjoined contracts :—Thompson and Company, railway and electric tramway crossing ; Electric Construction Company, 5 KW. motor-generator set for battery charging of baggage trucks, and switchboard and connections for single-phase motor drive ; Edison Swan Electric Company, six months' supply of incandescent electric lamps ; Gibson, Battle and Company, plant for impregnating electric apparatus with insulating varnishes ; R. W. Cameron and Company, transformers during five years.

Manchester Corporation have placed the following contracts :—Supply of steam disinfector, T. Bredford and Company, Limited, Salford ; low pressure water and exhaust steam-pipes and supports, Aiton and Company, Limited ; "Lea" recorder, Lea Recorder Company, Limited ; compressor equipment and drills, Ingersoll-Rand Company, Limited ; high and low pressure steam and water pipework, Stewarts and Lloyds, Limited ; valves, Blakeborough and Sons ; supply of cable, Western Electric Company, Limited ; British Insulated and Helsby Cables, Limited ; W. T. Glover and Company ; and Pirelli General Cable Works.

PERSONAL.

Mr. E. P. Austin, assistant borough electrical engineer at Chesterfield, has been granted an increase in salary.

Mr. T. P. Dudin, charge shift engineer at Greenwich generating station of the London County Council, has resigned as from December 24.

Mr. J. C. Williams, tramways manager and electrical engineer to Erith Urban Council, has been voted an increase of £50 per annum in his salary.

Mr. W. M. Girvan, a member of the staff at the Belfast Corporation electricity works, has been appointed general superintendent at the central generating station.

Sir William Slingo has been elected to the Council of the Institution of Electrical Engineers to fill a vacancy created by the resignation of Captain R. J. Wallis-Jones, due to military service.

Mr. W. B. MacCabe, chief engineer to the Corporation of Calcutta, has retired from that post, to which he was appointed in 1903, and intends to reside on an estate he has purchased in Tasmania.

Mr. A. H. Felton, works superintendent, Newport Corporation Electricity Works, has received an addition of £25 to his salary. Four other officials in the department have also been awarded increases.

Sir J. Baxter Ellis, a former chairman of Newcastle Tramways Committee, has been attacked by a serious illness, but at the December meeting of the Corporation the Lord Mayor announced that he was rapidly recovering.

Mr. A. W. Johnson, who has been in the service of the London County Council since June 1, 1908, has been appointed a charge shift engineer at Greenwich generating station at a salary of £250 a year, rising by annual increments of £10 to £300.

Mr. Arthur Towle.—At the request of the President of the Board of Trade, the Midland Railway Company have placed the services of Mr. Arthur Towle temporarily at the disposal of the department for work in connection with the regulation of meals and economy in the use of food.

Mr. J. W. S. Clunas has been confirmed in the appointment of city electrical engineer at Cape Town, to which he was appointed when Mr. W. F. Long became general manager of Cape Town Tramways Company. The salary is £900 per annum, with yearly increases up to £1,200.

Mr. J. M. McElroy, on concluding two days' sittings as arbitrator in the fares and stages dispute between Rawtenstall and Bacup Corporations, was accorded a vote of thanks on the motion of Sir Henry Maden. Subsequently Mr. McElroy walked over the whole length of the route in company with a representative from each side.

Mr. R. Owen, chief engineering assistant, Leeds electricity department, on resigning that position to become borough electrical engineer at Wigan, has received from the Electricity Committee a resolution congratulating him upon receiving the appointment, expressing regret at his resignation, and offering best wishes for his future career.

Mr. E. Eastwood, who for eleven years has had charge of the electrical repair shops of the London County Council Tramways at the central repair depot, has resigned that position, and has accepted the post of manager for the Electrical Repair Company, Martin's Yard, Endwell Road, Brockley, S.E. The company are specialising in all types of armature and field coil winding and repairs.

Auckland Tramway Staff.—In the course of his remarks as chairman at the annual meeting of the Auckland Electric Tramways Company, Mr. C. G. Tegetmeier referred to the difficulties under which the tramways had been operated during the year, and said that in view of all the circumstances it was highly creditable to the general manager, Mr. J. J. Walklate, and the engineer, Mr. F. E. de Guerrier, with the rest of the staff, that such good results were shown. In New Zealand, as in this country, the chairman added, the claim of the employees to increased wages consequent upon the extra cost of living had had to be recognised.

Presentation to a Lady Official.—A presentation was recently made by the Southampton women conductors to Miss Abbott, woman instructor and inspector, on her resignation of that position owing to her approaching marriage. The presentation was made by Mr. W. T. Robson, the general manager, who remarked that he had assisted at many presentations in many capacities, but this was the first occasion at which he had presided at a presentation to a lady official. Alderman Dunsford, chairman of the Tramways Committee, paid a tribute to the excellent work done by the women, which reflected the greatest credit on Miss Abbott, who had been responsible for their training, and had carried out her duties to the entire satisfaction of the manager and the committee.

Mr. George Kidd, general manager of the British Columbia Electric Railway, and the staff were cordially thanked at the annual meeting of the shareholders for their services during the past year. Mr. Harold Brown, a director, in moving the resolution, said it was

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difficult to speak too highly of the way in which the company had been served by the staff in the most difficult and trying circumstances. They had never lost heart, and had given the most untiring services in the endeavour to cut down the expenses, and to increase the earnings. The directors had had the advantage of seeing Mr. Kidd in this country during the autumn, and the more they saw of him the more they were confirmed in their view that they had the right man in the right place. Mr. M. Urwin, the London Secretary, acknowledged the vote.

Sir William Mackenzie was elected as an additional director of the British Columbia Electric Railway at the annual meeting in London on December 22, thus making the number of directors nine. Sir William is president of Toronto Railway Company, Toronto Power Company, Winnipeg Electric Railway Company, and other public utility enterprises in Canada, and the directors desired to secure for the company the advantage of his wide experience. Mr. R. H. Sperling having been granted a commission in the army, had retired from the board to the great regret of his colleagues, but he has accepted the position of adviser to the board, upon which Sir W. M. Aitken, M.P., and Mr. J. Davidson had accepted seats. The two latter gentlemen were re-elected at the annual meeting, together with Mr. G. P. Norton and Mr. Harold Brown. Gratification was expressed that the services of Sir Max Aitken had recently received further recognition.

WITH THE FORCES.

Colonel Weston Jarvis, of the Indiarubber and Telegraph Works, Silvertown, who has served in Gallipoli and Egypt, is now in England.

Sergeant Willis and **Corporal Liddell,** both of whom were in the architects' department of the London County Council, have been awarded the Military Medal.

Mr. A. G. Bradshaw, borough engineer of Lancaster, has been given an appointment with the rank of captain in connection with road construction and reorganisation schemes in France under Brigadier General Maybury.

Company-Sergeant-Major J. Carson, of the Australian Infantry, has been awarded the Military Medal for bravery in action in France. He emigrated to Australia five years ago from Glasgow, where he worked as a motorman on the Corporation Tramways.

Battery-Sergt.-Major C. F. Hunter, R.F.A., who enlisted from the Silvertown works of the Indiarubber and Telegraph Works Company, has been awarded the D.C.M. for extinguishing a fire which had been started among the ammunition in a gun pit by an enemy shell on the French front.

Captain H. Garrett, borough surveyor of Torquay, and Royal Engineers (T.F.), who for the past two years has held the position of chief engineer of the northern section of the Plymouth Garrison, has been appointed roads and communication officer for the whole of the Southern Command.

Sergt. G. W. Beckett, R.F.A., an employee at the Indiarubber Company's Works, Silvertown, has received the Military Medal for repairing telephone wires under fire, and for continuing to keep up communications. He had been mentioned in despatches for his work on a former occasion.

Mr. E. R. Alford, a conductor of the London United Tramways, who was called up as a reservist of the 1st Dragoon Guards at the outbreak of war, has been granted a commission as second lieutenant in the Loyal North Lancashire Regiment, and has also been awarded the Military Cross for special gallantry in leading an attack on October 14 last.

Edinburgh Tramwaymen's War Honours.—Sir Robert Maule, who presided at an annual concert held recently in aid of the Tramways Employees' Widows' and Orphans' Fund, stated that over 600 of the men had joined the colours, most of them voluntarily. The D.C.M. had been awarded to Conductor W. Borthwick, Driver John S. Smith, Driver W. M'Lennan, and Donald Hunt, of the engineers' staff. Corporal Bathgate, who had been with them back in the days of the horse cars, had been wounded three times, and had passed through fourteen important battles. They were heroes all. When one thought of what such men had done for the Empire the heart thrilled at their courage and devotion to duty.

Lieutenant E. R. Wilmshurst, Royal Fusiliers, who died from wounds on December 1, aged 21, was the second son of Mr. T. P. Wilmshurst, borough electrical engineer and tramways electrical engineer at Derby. Three of Mr. Wilmshurst's sons enlisted on the outbreak of war, each was wounded, and afterwards was awarded a commission.

Private G. W. Falconer, a Chesterfield Corporation Tramways conductor, aged 19, who has been killed by a shell while sitting in a trench in France waiting to be conveyed to hospital, enlisted in 1914. He fought in the Gallipoli landing and was invalided home wounded and suffering from shell shock. In June last he was sent to France, and a month later was wounded. On recovery, he was again drafted to the western front, and took part in severe fighting.

TRAMWAY AND LIGHT RAILWAY NOTES.

ASHTON.

PURCHASE OF TRAMWAYS.

The Ashton-under-Lyne Corporation have decided to promote in the next session of Parliament a bill to make provision for the purchase of the Oldham, Ashton, and Hyde Tramway Company's undertaking. Agreements are to be confirmed with the Parish Councils of Waterloo and Bardsley for the transfer of their powers to the Corporation. The bill also authorises the Corporation to construct additional tramways in the borough, and to provide and run omnibuses. It is hoped to establish through inter-running between Ashton and Oldham.

BIRMINGHAM.

TRAMWAY ON A BY-PASS ROAD.

A deputation of property owners and tradesmen in High Street, Northfield, recently waited upon the Lord Mayor of Birmingham and expressed objection to the Town Planning Committee's scheme for a by-pass road which would carry a tramway on a sleeper-constructed track in order to avoid passing through the High Street. The deputation feared that the new road would lessen the value of property in the High Street, and lead to the development of a new shopping centre near the tramway. The Lord Mayor (Alderman N. Chamberlain) said that the by-pass road had been designed in order to enable the tramway to be carried on sleepers throughout its whole length. This method of construction would be impossible in the village without such a widening as would involve the Corporation in heavy cost.

BRADFORD.

PERMANENT WAY CONTROL.

Provided the scheme receives the sanction of the City Council, an arrangement has been made by the Tramways Committee and the Finance and General Purposes Committee to transfer the control of the permanent way work from the city engineer to the general manager of the tramways. The staff and workmen employed on the permanent way have always been part of the tramway organisation, and have received their pay from that department.

DARLINGTON.

PROPOSED INCREASE OF FARES.

The Darlington Corporation are applying to the Board of Trade under the war emergency powers for a Provisional Order to enable them to make a charge of more than one penny on certain sections. Alderman C. W. Starmer, chairman of the Tramways Committee, in introducing the proposal to the Council, observed that so long as they were restricted to a penny fare from the centre of the town they could not extend the lines to Haughton-le-Skerne. It was not right that they should not be allowed to charge more than one penny to that place when they charged one penny now for about half the distance, seeing they would have to spend about £8,000 in laying the track. He had no doubt that if the proposed amended Order was obtained the fare for the two miles to Harrowgate Hill would be increased to three-halfpence.

DUNDEE.

NO RENEWALS CONTRIBUTION—SUGGESTED SIDING FOR A SCHOOL.

The Tramways Committee recently granted a suggestion from the Medical Panel Committee to carry panel patients attending the Royal Infirmary from High Street to the gate for a halfpenny on showing their medical cards between the hours of 4.30 p.m. and 8.30 p.m. until March 31. It was on account of the shortage of medical practitioners and the darkening of the streets that the suggestion was made. Councillor G. A. Johnston, chairman of the Tramways Committee, stated that the last increase of pay to the tramways employees had wiped out any surplus that they expected to be able to put to the renewals fund this year, according to the estimate of the manager. Any privilege of this kind must be at the expense of the general users of the cars, and unless they conserved their interests they might have to face the question of increased fares. On account of the danger of embarking and disembarking of the 113 physically defective, and 43 mentally defective children attending Fairmuir School on the main tramway line owing to the passing traffic, the Tramways Committee have asked the general manager to report upon the subject of constructing a cross-over or a short siding. Two cars are used for the conveyance of the children, and the School Board pay the Tramways Committee 12s. a day.

HULL.

PROPOSED TEMPORARY ABOLITION OF HALFPENNY STAGES.

By 19 votes to 16 a special meeting of Hull Corporation on December 27 referred back to the Tramways Committee for further consideration the recommendations that halfpenny stages be suspended during the period of the war, that a flat rate of one penny be charged on each route, and that no change be made in the present arrangements under which soldiers have free use of the cars on weekdays. Councillor W. Wheatley, chairman of the committee, advocated a charge of one halfpenny for soldiers, suspension of the early halfpenny fares, abolition of transfer tickets to and from the

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Old Town within the docks, and a reduction in the number of stopping places, so as to save wear and tear, and reduce the consumption of energy. He stated that there would be a large influx of service men to Hull, and that the tramway employees had made a request for a further bonus of 3s. per week and an increase of 3d. per hour in the payment for overtime. These demands would cost £6,500, and, added to his estimate of a loss of £2,500, the total loss at the end of the financial year would be £9,000. He wanted the Council to accept the responsibility. In supporting the committee's recommendations, Alderman Hargreaves, ex-chairman of the committee, said it was not surprising an alteration was required in a tariff that was fixed in normal times. War expenses could not be paid out of a tariff fixed in time of peace. Seventy thousand men who might be classed as more or less permanent passengers were out of the town. For every hour the service was suspended on the occasion of alarms there was a loss of £20. On January 4 the committee decided to recommend the Council to suspend the halfpenny stages after 9 a.m., and to charge a flat rate of one penny, to charge soldiers and sailors one halfpenny, and to abolish the transfer system from various routes to the Old Town.

KILMARNOCK.

Extensions of Power Plant.

The borough electrical engineer (Mr. Bexon) has reported that in his opinion Sir Alexander Kennedy's recommendation to instal a further 3,000 KW. turbo-alternator will not meet the future requirements of the undertaking. He advises a 5,000 KW. set in order to give a reasonable margin of reserve. Mr. Bexon also points out that there is at present insufficient boiler capacity to deal with the new load, and recommends the disposal of two of the three Lancashire boilers now in use, and the substitution for them of a Babcock and Wilcox boiler with an evaporative capacity of 25,000 to 30,000 lb. of steam per hour. The comments of the borough electrical engineer are to be referred to Sir Alexander Kennedy for his opinion.

LONDON.

Proposed Re-organisation of County Council Tramways.

At a meeting of the London County Council on December 19, Mr. G. H. Hume, chairman of the Highways Committee, said that war conditions had seriously interfered with the various services, but early in 1917 the committee would put before the Council a series of most important proposals based on the recommendations of the sub-committee, who were considering the question of the organisation of the tramways. They were in need of more assistance as tramway administrators, and they would have to ask the Council for it. The existing staff was working hard and successfully on a very difficult situation.

NOTTINGHAM.

First Fatal Accident in Sixteen Years.

The coroner's inquiry was opened on December 29 into the deaths of two pedestrians who were killed on December 26 by the overturning of a Nottingham tramcar. The original cause of the mishap was the running away of another car on the Derby Road hill after the trolley pole had left the wire. On reaching the end of Market Street the runaway collided with the other car, which was knocked some yards away and then fell over on its side. The runaway was derailed by the collision, and came to a standstill at the end of King Street. This was the first occasion on which a Nottingham car has overturned during the sixteen years in which the tramways have been in operation, and the town clerk informed the coroner that never before had anyone lost their life or been seriously injured as the result of a car running away. The inquest was adjourned until January 11.

PONTYPRIDD.

Reorganisation of Tramway Department.

The Urban Council of Pontypridd have decided to reorganise the tramway department, and to appoint a traffic manager in place of a superintendent.

RHONDDA VALLEY.

Recognition of a Woman Conductor's Alertness.

Mrs. Jones, a conductor employed by the Rhondda Tramways Company, was recently presented with a marble clock in recognition of her promptitude in applying the brake and bringing to a standstill a car which was running out of control down Pentre Hill. Mr. H. Holliday, chief engineer and general manager of the company, in making the presentation on behalf of the subscribers, said that had it not been for the presence of mind of Mrs. Jones there might have been loss of life, as the car was crowded with colliers. She had done her duty well at considerable personal risk.

SALFORD.

Two Days' Strike Over Women Inspectors.

At Salford, on December 17 and 18, the men and women tramway employees left their work because Mr. G. W. Holford, the general manager, had promoted eight of the women conductors to inspectorships. As they were only to supervise the women conductors their wages were fixed at 30s. a week. The men inspectors receive 40s. or over, for they have to be qualified to drive a car, to effect running repairs, and to control traffic. The men contended that women who had been in the service for less than a year should not be promoted over the heads of men who had been on the cars for years. The general manager communicated with Alderman Jackson, the general secretary of the Tramway and Vehicle Workers' Association, and on December 17 a deputation of the men requested the Tramways Committee to withdraw the women inspectors as a preliminary to negotiations. This course was agreed to. Then the objection was raised that reference of the matter to the Committee on Production would entail delay. To obviate that contingency both parties agreed to accept the stipendiary magistrate as arbitrator. That gentlemen at once went to the depot, but a meeting of the employees repudiated the action of their delegates and insisted on the unconditional withdrawal of the women inspectors. During the second day's cessation of the services, the chairman of the Tramways Committee and the general manager attended the Manchester office of the Ministry of Munitions, and the representative (Mr. Higson) offered to talk with the employees. As a result of conferences the committee decided to withdraw the female inspectors from the cars pending the decision by the arbitrators as to whether women should be employed, and their rate of wages.

"PALNUT" LOCK WASHERS.

Engineering workers of all classes of mechanical trade have been troubled in the past with a nut which is always working loose. The expense of fitting lock nuts is a considerable one, and is only undertaken where the machinery is of the highest class. Attempts to provide other devices which prevent the nut working loose in vibration have not always been attended with success, owing principally to the fact that the devices had so firmly gripped the thread of the bolt that they damaged it considerably.

The old-fashioned split washer is a very poor substitute, as it only gives prolonged friction after the nut has started working loose, and gradually diminishes its hold as the nut turns. This is due to their being too tightly bound into the thread. In other cases a series of inwardly projecting points have been adopted which dig into the thread as the nuts tend to work loose. The damage caused to the thread by this type can be easily imagined, and verified in practice by those who use this type. In many cases it has been impossible to remove the bolt owing to the damage incurred.

The "Palnut" lock washer, as sold by the Equipment and Engineering Company, is free from this defect. It has been scientifically designed so that it does not engage the thread at one or

two points only, but engages practically the whole circle. Its edge is turned up all round so that the standard spanner can be used. The illustration shows the application to any ordinary bolt, where it will be seen that the washer is screwed down on top of the nut and can be removed at any time with an ordinary spanner. The washers are made of special spring steel, and are domed in shape, so that with pressure they tend to fasten and secure the bolt. Their field of use is enormous. To the railway engineer they provide an effective lock for the bolts of fish plates, besides his numerous requirements for securing bolts in point rods and signal gear. The light weight of the lock washer makes it specially applicable to the motor car and aeroplane trades.

Tramway engineers will appreciate its value for securing the nuts upon their cars, which are always subject to an enormous amount of vibration. The Equipment and Engineering Company (2, Norfolk Street, London, W.C.) will be glad to supply samples of any size washer on application.

FOR HIGH-CLASS
CONDENSING PLANT
WRITE TO
THE MIRRLEES WATSON CO., LTD.,
SCOTLAND STREET, GLASGOW.

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PATENT LIST.

Abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

***** If the inventions have been communicated the names of the communicators are given below in italics.**

APPLICATIONS FOR LETTERS PATENT.

Non-flashing electric trolley arm (17,244)—D. Branson.
Motor vehicles (17,345)—Daimler Company and F. W. Lanchester.
Rail joints (17,140)—E. Dossor, W. R. Kent, and G. W. Sharp.
Braking or retarding motor road vehicles (17,344)—A. E. Ford.
Speed indicators (17,184)—H. J. Leviseur.
Self-propelled vehicles (17,249)—R. F. Macfie.
Driving road wheel for motor chassis adapters (17,020)—T. L. McGee and S. J. Murphy.
Controlling mechanism for power-driven vehicles (16,991)—E. C. R. Marks (*Mercury Manufacturing Company*).
Direction indicators for road traffic (17,139)—J. Morgan.
Trolley-pole heads (17,231)—H. E. Warsop.
Signalling apparatus for regulating street traffic (17,641)—W. T. Bell.
Means for securing railway rails in chairs (17,534)—R. Bowen.
Rear-springing system for motor road vehicles (17,531)—E. D. Edwards and F. W. Edwards.
Signals for road vehicles (17,578)—H. E. Halfacree.
Back axle reduction gear for motor vehicles (17,686)—Rolls-Royce, Limited, and F. H. Royce.
Fastening device for securing rails to metal sleepers (17,679)—H. A. Rugeroni.
Trolley heads (17,852)—R. Baty.
Appliance for announcing to passengers in vehicles name of next stopping-place (17,975)—W. L. Box.
Petrol engines (18,093)—D. St. C. Campbell and K. McColl.
Automatic train stop device (18,007)—T. T. Chaloner.
Automatic grease cup for lubricating bearings of mechanically-propelled vehicles (18,074)—C. H. Chapman.
Cross-overs for mono-rail systems (17,781)—P. English.
Collection of current from overhead conductors (17,993)—C. C. Henkes.
Control valves for air brakes (17,935)—Knorr-Bremse Akt.-Ges. and W. Hildebrand.
Cleansing floors of tramcars (18,019)—N. Jamieson.
Road-gripping device for heavy self-propelled road vehicles (18,029)—T. E. Pooler.
Fluid-pressure brake systems (18,375)—W. M. Cady and W. V. Turner.
Steam-heating systems for railway and tramway vehicles (18,352)—C. C. Champeney.
Electro-pneumatic brakes (18,374)—E. H. Dewson.
Motor road vehicles (18,382)—E. Dobson.
Signalling apparatus for use on road vehicles (18,401)—A. H. Kelday.
Appliance for taking moulds of railway rails *in situ* (18,502)—A. Wood-Hill.
Speedometer driving mechanism (18,467)—C. F. L. King.
Stopping-place indicators for tramway and railway vehicles (18,461)—G. A. Storey.
Longitudinal sleepers (18,533)—O. Valeri.
Trolley-heads for electric tramcars (18,624)—J. N. Waite.
Destination annunciators for passenger vehicles (18,492)—F. Wilde

SPECIFICATIONS PUBLISHED.

1915.

Electrically-driven vehicles (17,128)—British Thomson-Houston Company (*General Electric Company*).
Trucks for tramway or railway vehicles (18,215)—Thomas and Stait-Gardner.
Triple valves for air-brake systems (16,017)—Canion.
Chassis and steering mechanism of motor vehicles (16,507)—Gill (*Van Vleet, Maxwell and Haley*).
Rail tie structures (16,601)—Smith.
Safety device for rope inclined railways (18,179)—Proctor and Proctor.
Variable speed gear (16,595 and 16,596)—D. Napier and Son, Ltd.
Moulds for casting brake blocks (16,739)—Williams.
Self-propelled vehicles (16,920)—Watney.
Check rails, guard rails, points, and crossings (17,361)—Laybourne. (*Dutton*).
Means for locking differential or balance gear of a motor vehicle (17,944)—Wolseley Motors, Limited, and Reeve.

1916.

In the following list the numbers in italics are those that the specifications will finally bear and under which they will be indexed and abridged before acceptance and finally printed. The application numbers should, however, still be used for correspondence purposes.

Direction indicators for use on motor vehicles (1,031—*101,991*)—E. G. Archer.
Jacks (12,185—*102,037*)—A. A. Scott.
Control handle for motor-propelled vehicles (2,610—*102,083*)—S. Sadler.
Brake mechanism (3,812—*102,095*)—W. O. Kuhn.
Transmission gearing for motor vehicles (3,814—*102,096*)—W. O. Kuhn.
Means for joining railway rails (7,536—*100,680*)—T. M. Daniels.
Railway sleepers and means for securing rails thereto (10,901—*102,238*)—K. Jarvi and K. Makinen.
Fenders for motor vehicles (476—*102,277*)—S. Yanagidate.
Lubrication of motor vehicles (5,361—*102,319*)—J. B. Ferguson.
Extensible car steps (8 763—*100,837*)—A. Arnt.
Concrete sleepers for railways and tramways (11,469—*102,467*)—R. S. Santalo.

TO BRITISH FIRMS.—Gentleman, good standing, Melbourne connection Australian Tramways, open correspond, view taking up agencies on commission. London references supplied. Write in the first instance to "Tractor," care of THE TRAMWAY AND RAILWAY WORLD, Amberley House, Norfolk Street, London, E.C.

Colonial and Foreign Tramways Traffic Returns.

NAME OF COMPANY.	1915. WEEKS ENDED. Dec. 4	Dec. 11	Dec. 18	Dec. 25	Jan. 1	1916. WEEKS ENDED. Dec. 2	Dec. 9	Dec. 16	Dec. 23	Dec. 30	AGGREGATE. Wks.	1916.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Anglo-Argentine	51,954	54,110	51,874	52,156	60,549	52,450	52,955	53,833	53,083	58,103	53	2,672,405	+ 4,677
Auckland ... ... $	...	(28 days)	21,804	...	...	...	(28 days)	21,682	...	...	24	126,697	+ 857
Calcutta ... ... Rs.	66,149	67,263	67,381	67,680	65,872	72,607	72,671	72,265	73,174	72,441	53	3,494,611	+200,370
Madras ... ... Rs.	(2 weeks)	28,668	(2 weeks)	36,150	...	(2 weeks)	31,938	(2 weeks)	40,770	...	52	767,878	+ 58,901
Pernambuco ... ... $	3,242	3,199	2,073	3,669	...	3,500	3,553	3,500	4,200	...	51	159,250	+ 1,004

Companies Issuing Monthly Statements.

	1915. July.	Aug.	Sept.	Oct.	Nov.	Dec.	1916. July.	Aug.	Sept.	Oct.	Nov.	Dec.	Wks.	AGGREGATE. 1916.	+ or -.
	£	£	£	£	£	£	£	£	£	£	£	£		£	£
Ballarat & Bendigo ...	2,677	2,860	3,075	3,401	3,586	...	2,704	2,791	2,850	3,390	3,429	...	32	25,539	+ 443
Brazilian Traction Mlrs	6703000	6576000	6494000	6793000	6336000	...	7195000	7184000	6920000	7037000	6943000	...	48	75,229,000	+4,642,890
Brisbane ...	31,150	35,064	30,360	31,880	31,120	...	32,880	37,900	32,530	32,760	26,740	...	48	357,160	+ 10,086
British Columbia $	510,723	507,126	517,022	538,826	562,782	...	538,293	550,293	540,440	573,544	604,576	...	22	2,807,146	+ 170,667
Buenos Ayres Lacroze	41,460	41,468	39,355	43,516	46,033	43,528	38,439	36,431	37,075	39,670	42,603	40,106	26	230,895	- 20,036
Burma	...	25,159	22,163	25,531	23,695	...	...	24,412	23,749	29,768	26,824	...	18	104,753	+ 8,205
Cape Town	...	...	...	...	...	...	13,357	13,394	...	14,238	...	...	—	—	—
Carthagena & Herrerias	2,157	1,523	1,252	2,169	2,090	2,129	2,371	2,081	1,779	2,539	2,252	2,399	52	29,790	+ 7,822
Cordoba	14,375	14,159	13,210	13,441	...	...	14,263	13,852	13,389	13,533	...	...	31	98,087	+ 740
East India	2,231	2,266	2,054	2,069	2,065	2,062	2,220	2,522	2,523	2,080	1,942	2,120	22	11,187	+ 671
Kalgoorlie	2,775	3,165	2,997	...	...	...	2,521	3,021	2,788	...	...	...	39	23,267	- 1,849
La Plata	4,054	4,164	3,894	4,405	4,564	4,563	3,909	3,792	3,994	4,435	4,342	4,436	52	50,836	- 556
Lima	...	32,004	30,530	32,211	30,720	...	...	33,395	33,348	33,292	33,625	...	48	370,975	+ 19,763
Manaos ... Rs.	...	...	...	...	...	...	152,380	147,774	141,286	...	...	...	—	—	—
Manila	23,750	...	...	...	...	...	...	33,700	...	...	...	...	31	887,739	+ 39,986
Melbourne	...	...	...	...	...	...	...	...	...	...	...	...	—	—	—
Mexico ... $	...	...	...	...	...	...	...	...	...	...	...	...	—	—	—
Monte Video	25,161	26,494	25,070	27,167	28,407	31,305	25,220	26,044	26,711	...	28,404	31,364	9	59,768	+ 56
Peruvian ... $	724,838	819,039	755,280	806,900	751,720	...	835,430	895,900	911,910	945,590	925,820	...	22	4,514,650	+ 656,873
Port Elizabeth ...	...	...	...	...	...	...	3,166	2,863	...	3,131	...	...	—	—	—
Rangoon	4,629	4,510	4,445	4,886	5,028	4,492	4,357	4,253	4,137	5,043	5,033	4,904	52	56,308	- 1,427
Toronto ... $	773,013	762,627	804,902	792,001	851,113	...	867,789	889,241	913,535	907,460	911,829	...	48	9,825,053	+1,031,334
Winnipeg ... $	248,022	251,189	261,982	286,146	323,025	...	242,688	249,795	267,497	278,817	282,899	...	48	3,023,170	- 99,450

(*Continued on page 36*)

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TRAFFIC RETURNS—*continued.*

Tramways and Omnibus Undertakings in the United Kingdom.

NAME OF COMPANY OR CORPORATION.	1915–16. WEEKS ENDED.					1916. WEEKS ENDED.					AGGREGATE.		
	Dec. 4	Dec. 11	Dec. 18	Dec. 25	Jan. 1	Dec. 2	Dec. 9	Dec. 16	Dec. 23	Dec. 30	Wks.	1916.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Aberdare U.D. Council	328	363	347	338	469	397	393	352	338	464	39	15 477	+ 1,649
Aberdeen Corporation	1,714	1,656	1,670	1,709	1,901	1,782	1,882	1,787	1,805	1,901	30	57,833	+ 3,388
Accrington Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
Ayr Corporation	230	235	237	256	269	262	256	249	268	283	33	14,296	+ 1,239
Bath Electric	*	...	...	...	...	...	...	...	...	...	—	—	—
Birkenhead Corporation	1,284	1,378	1,378	1,422	1,421	1,521	1,445	1,400	1,593	1 368	39½	60,731	+ 6,096
Birmingham Corporation	14,687	15,846	15,610	14,507	16,031	13,637	13,850	13,039	15,704	14,297	39	621,083	+ 54,578
Birmingham Corp. Motor Omnibuses	721	814	751	755	793	1,022	905	859	868	664	39	38.867	+ 5.423
Blackburn Corporation	1,012	1,017	1,026	1,128	1,227	1,061	1,030	1.022	1,022	1,253	39½	49,508	— 963
Blackpool and Fleetwood	...	...	...	...	...	...	...	...	...	318	399	52	43 971	+ 5,343
Blackpool Corporation	*	...	...	...	...	...	...	...	...	...	...	—	—	—
Bolton Corporation	2,426	2,554	2,606	2,762	3,040	2,731	2,685	2,693	2.996	2.938	40	115 024	+ 7,975
Bournemouth Corporation	1,717	1,701	1,904	2,037	1,998	1,781	1,759	1,756	1,898	2,078	40	92.419	+ 6,667
Bradford Corporation	5,622	5.746	6.530	6,045	5,963	6,445	5,982	6,950	6,144	5,803	39	267,129	+ 9,908
Brighton Corporation	837	874	850	954	990	958	958	946	1,116	1,007	39½	50,344	+ 5,445
Bristol	9,776	10.023	10,122	12,698	13,134	9,831	9.609	9.484	11,265	11.919	52	527,104	+ 20.181
Burnley Corporation	1,438	1,499	1,526	1,700	1,779	1,605	1,503	1,544	1,528	1,746	40	68.084	+ 3,587
Burton-on-Trent Corporation	270	293	271	315	364	250	248	262	339	259	39	10,947	— 629
Bury Corporation	1,144	1,183	1,216	1,320	1,368	1,242	1,171	1,139	1,237	1,310	39½	56,212	+ 2,319
Cardiff Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
Chatham and District	981	1,016	1,039	1,139	1,301	1,172	1,028	1,078	1,058	1,593	52	63.991	+ 3,634
Chesterfield Corporation	243	251	262	273	316	242	232	238	245	271	39	10,817	+ 163
Colne Corporation	...	...	...	...	...	...	...	...	...	...	—	—	—
Cork Electric	439	451	432	496	568	474	480	445	470	723	52	26,685	+ 660
Croydon Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
Derby Corporation	950	1,016	988	1,015	1,244	978	933	996	1,163	953	39½	44,481	+ 2,730
Dover Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
Dublin and Lucan	114	99	105	129	147	135	117	107	126	201	26	4,251	+ 383
Dublin United	5,624	5,756	5,714	6,938	...	6,052	6,070	5,973	6,552	...	—	—	—
Dundee City	1,280	1,264	1,264	1,331	1,399	1,316	1,304	1,279	1,340	1,379	32½	45,203	+ 1,057
East Ham Corporation	1.215	1,278	1.343	1,393	1,312	1,154	1,163	1,090	1.175	1,074	39½	50.871	— 732
Exeter Corporation	306	324	320	392	324	390	363	341	400	363	39	15.919	+ 946
Gearless Motor 'Buses	*	...	...	...	...	...	...	...	...	...	—	—	—
Glasgow Corporation	20,997	21,013	21,807	22.290	22,784	23.347	23,130	22.706	22,942	23,922	30½	715,746	+ 54.703
Glasgow Subway	1,232	1,247	1,276	1,246	1,250	1,246	1,284	1,356	1,441	1,444	52	60 910	+ 4.850
Glossop (Urban Elec. Supply Co.)	119	127	123	132	144	134	126	124	128	141	52	7,343	+ 693
Halifax Corporation	1,808	1,772	1,774	1,944	2.158	1,872	1,865	1,779	1,815	1,910	38½	86,296	+ 738
Halifax Corp. Motor Omnibuses	38	39	37	41	50	48	44	45	44	50	38½	1,927	+ 7
Hastings and District	667	678	721	849	1,064	850	834	840	928	1,358	52	54,070	+ 4,008
Huddersfield Corporation	2,317	2,384	2,437	2,636	2,642	2,595	2,495	2,547	2,642	2.513	39	110.939	+ 8.817
Hull Corporation	3,121	3.232	3,176	3,217	3,421	3.072	3,149	3,165	3,374	2.903	39	123.112	+ 1.369
Ilford U.D. Council	577	614	617	636	686	601	604	582	682	534	39	26,666	+ 1,189
Ilkeston Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
Ipswich Corporation	444	477	467	504	551	389	381	394	454	407	39	20,201	— 1,467
Isle of Thanet	202	236	216	258	292	236	214	222	251	264	13	3,458	+ 6
Kilmarnock Corporation	150	149	153	163	197	176	161	156	169	185	32½	5,782	+ 195
Lanarkshire	1,901	1,862	2,008	1,985	...	2,186	2,111	2,096	1,969	...	—	—	—
Lancashire United	1,451	1,482	1,519	1,546	1,805	1,724	1,682	1,612	1,402	1,924	52	94,776	+ 5,468
Leeds City	8,203	8,483	8,641	8,996	9,515	9.331	9,051	9.257	9,451	9.584	40	386 378	+ 33,738
Leicester Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
Leith Corporation	695	697	706	749	821	830	807	793	813	868	32½	28.819	+ 3.560
Leyton U.D. Council	1,400	1,407	1,521	1,627	1,588	1,444	1,493	1,453	1,394	1,380	39	64,375	+ 502
Liverpool Corporation	12,672	13,382	13,625	14.283	13,896	13,963	13,951	13,685	15,017	13.392	52½	736,265	+ 39,978
Llandudno and Colwyn Bay	92	168	206	204	189	162	187	211	196	228	4½	822	+ 7
London County Council	42.807	44,922	...	...	...	45,367	44.565	...	...	...	35½	1,729,904	+ 154,254
London General Omnibus	*	...	...	...	...	...	...	...	...	...	—	—	—
London United	*	...	...	...	...	...	...	...	...	...	—	—	—
Lowestoft Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
Maidstone Corporation	170	180	186	204	219	185	176	175	190	209	39	8,545	— 119
Manchester Corporation	16,558	17,289	17,706	17,463	17,445	17,999	17,400	16,594	17,762	16,537	37	736,366	+ 36,253
Metropolitan Electric Tramways	*	...	...	...	...	...	...	...	...	...	—	—	—
National Steam Car	*	...	...	...	...	...	...	...	...	...	—	—	—
Nelson Corporation	...	...	...	...	...	...	...	...	...	...	—	—	—
Newcastle-on-Tyne Corporation	5,609	5,724	5,778	5,919	5,424	6,742	6.570	6,658	6,999	6,385	38	264,093	+ 18.573
Newport (Mon.) Corporation	793	849	818	856	967	914	948	893	1,067	873	39	37,845	+ 4,443
New St. Helens and District	834	892	906	929	1,097	965	963	947	849	1.136	26	29,267	+ 2.161
Northampton Corporation	591	652	631	794	686	710	670	704	781	754	39	29.215	— 503
Nottingham Corporation	3,397	3,619	3,580	3,804	3,745	3,778	3,554	3,661	3,626	3,339	39	152, 764	+ 6.083
Oldham Corporation	2,022	2,093	2,131	1,978	2,282	2,192	2,141	2,042	2,265	1,897	40	98,220	+ 5,227
Portsmouth Corporation	1.947	2,031	2,104	1.994	2,285	2,149	2,054	2,148	2,318	1,946	—	—	—
Preston Corporation	910	977	1,000	1.007	1,023	1,091	1,052	1,062	1,037	1,131	38½	43.331	+ 5,305
Provincial	1,867	1,998	2,028	2.041	2,257	1.892	1,839	1,841	2,093	1,907	13	26,437	— 239
Reading Corporation	699	786	773	867	873	848	792	808	855	877	39½	33.785	+ 2.648
Rhondda Tramways	1,089	1,121	1,170	1,141	1,512	1.255	1,230	1,162	1.196	1.650	52	67,144	+ 5,753
Rochdale Corporation	1,419	1,525	1,541	1,659	1,746	1,579	1,454	1,498	1,476	1,693	39½	69,883	+ 2.267
Rotherham Corporation	1.162	1,199	1,216	1,306	...	1,495	1.494	1,494	1,361	...	—	—	—
Salford Corporation	4,760	4,922	5,133	5,193	5,287	5,126	4,951	3,403	4,756	5,023	38½	214,347	+ 8,710
Sheffield Corporation	9,029	9,400	9,418	8,830	9,446	10,496	10,464	10,634	9,933	10.489	40½	423,860	+ 62,267
Southampton Corporation	1,334	1,409	1,416	1,541	1,438	1,573	1,528	1,552	1,578	1.577	38½	65,363	+ 6,230
Southend-on-Sea Corporation	532	579	587	623	651	644	627	636	602	648	39	36.760	+ 4.130
South Metropolitan Tramways	*	...	...	...	...	...	...	...	...	...	—	—	—
South Shields Corporation	707	737	729	806	799	808	780	805	844	872	39½	33,212	+ 1,896
Sunderland Corporation	1,460	1,526	1,472	1,626	1,698	1,565	1,548	1,648	1,791	1,692	39	65.165	+ 5,129
Sunderland District	536	510	572	543	683	624	594	587	622	642	9	5,630	+ 642
Swindon Corporation	...	...	...	196	251	...	...	...	206	253	38½	8.080	+ 356
Torquay Tramways	353	359	380	390	467	463	448	432	465	564	52	30,592	+ 2,790
Tramways (M.E.T.) Omnibus Co.	*	...	...	...	...	...	...	...	...	...	—	—	—
Tyneside Tramways and Tramroads	473	467	479	505	545	572	562	530	541	616	26	16,993	+ 1,522
Wallasey Corporation	1,084	1,137	1,084	1,182	1,238	1,166	1,133	1,114	1,247	1,125	39½	54,079	+ 3.114
Walsall Corporation	725	810	784	881	997	776	761	764	819	726	53	42,622	— 3,092
Walthamstow U.D. Council	702	745	737	797	850	913	900	891	999	830	39	45,730	+ 10.252
Warrington Corporation	458	484	484	485	...	525	500	482	505	...	—	—	—
West Ham Corporation	2,809	2,938	3,006	2,979	3,069	2,912	2,971	3.048	3,280	2,790	38½	125,345	+ 4,332
Wigan Corporation	1.416	1,493	1,536	1,625	1,720	1,695	1,614	1,595	1,448	1,777	39	65,888	+ 5,414
Wolverhampton Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
Yorkshire (West Riding)	1,372	1,610	1,460	1,726	1,799	1,768	1,578	1,630	1,733	2,022	53	93 245	+ 9,517

* TRAFFIC RETURNS SUSPENDED.

Owing to the European war, the Government have taken over the railways of Great Britain as from August 4, 1914, and the issue of traffic returns has been suspended. Consequently the traffic returns of the electric railways which usually appear on this page cannot be given.

The Publication of the Traffic Returns of the Tramways marked with an asterisk in the above table have also been suspended during the war.

TRAMWAY DIRECTORIES.

A useful feature of this issue is the directory of electric railways and electric tramways which will be found among the advertising pages. This directory contains the names of the chief officials and the principal particulars relating to each undertaking.

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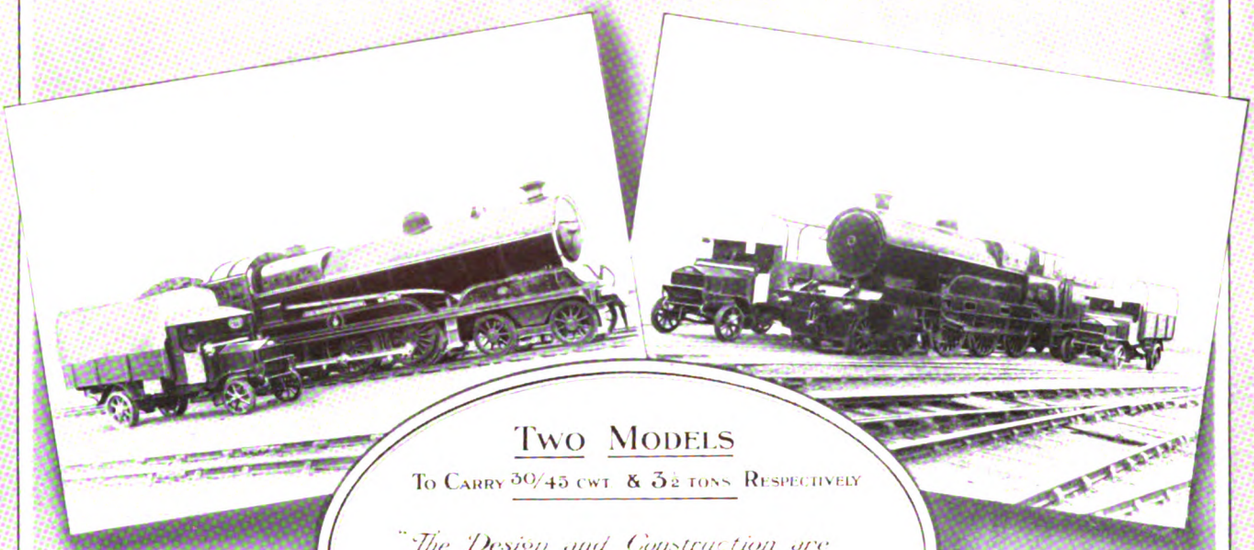

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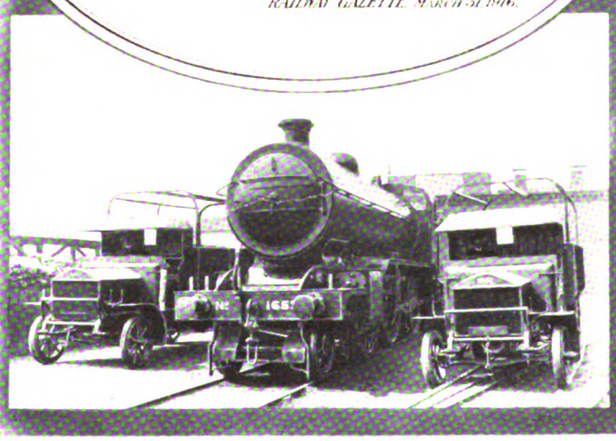

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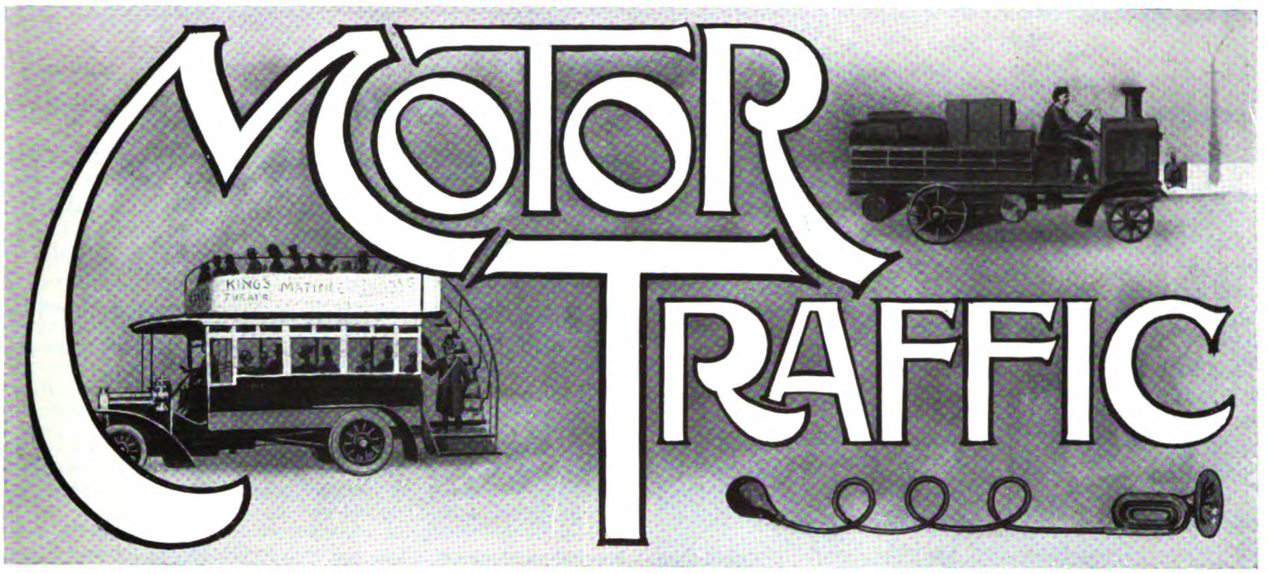

For owners and users of motor vehicles of every kind the year of which we have recently taken leave has involved anxiety and trouble in almost every possible direction. To such an extent has this been true that we are perhaps justified in looking forward to 1917 with positive optimism, in the belief that the experiences of its predecessor could not be worse. There have been difficulties in getting new vehicles, in obtaining spares and replacements; then came the fuel restrictions. The latter having been mitigated to some extent, and general conditions being what they are, the first-named are no longer so important as they might have been, and to-day the chief preoccupation in regard to the running of motor vehicles in all services is that of labour. This overshadows, of course, all other considerations, as neither vehicles nor fuel are of much avail if drivers cannot be obtained. That drivers are hard to get is only too obvious. Even the most important public services are being carried on with the greatest difficulty on this account, and omnibus and other passenger services have for some time past been drastically curtailed. In this connection, however, it is probable that the worst has been passed. The men now remaining are not likely to be withdrawn, unless in the gravest of emergencies, and as a compensation for those who have gone into the army there are a certain number who have been discharged now beginning to offer themselves, and the result is that, for the lighter types of vehicles especially, the driver difficulty is a shade less acute than was the case a few months ago. This, needless to say, must eventually have some effect, if indirect, upon the supply of men available and suitable for heavier and more exacting services. Thus, taking all things into consideration, there appears to be no reason why 1917 should be a more difficult year for motor users than last. The fuel question appears in a large degree to have adjusted itself, and the impossibility—or all but impossibility—of procuring new chassis just now is not of very serious moment, and, so far as one can see at present, the problem of drivers is more likely to become easier than more urgent. In any case all these troubles are merely temporary, and destined to pass away with the termination of the war. For that reason the year 1916, stressful as it has been, will have made little or no history so far as motor transport in the ordinary way is concerned, and it will figure in times to come more as a troublous interregnum than anything else.

There is one event, however, of the past year that calls for comment apart from others, and that is the passage into law of the Local Government (Emergency Powers) Act. Its effect, on the whole, has been of a negative character—which, presumably, was its intention—and up to the present time it has not given rise to serious difficulties. Other causes, quite apart from legislation of this kind, would have had the effect of restricting new motor passenger services to the very narrowest limits, and the Act seems to be chiefly notable for the precedent that it creates. This again is a war emergency measure, but the possibility of its forming in the future a basis for settling the whole question of the powers of public authorities in relation to omnibus services operating over their roads has been discussed. There is no doubt that a definite settlement of this rather vexed controversy is greatly to be desired, but it is doubtful whether, either as a matter of justice to motor omnibus proprietors or from the point of view of public interest, it is expedient to continue a policy of mulcting one particular form of traffic to the exclusion of others, which may use the roads just as extensively. On the other hand, it is quite certain that you cannot set out to make special levies on motor traffic as a whole. That would be bringing back the old toll-gate days, and would be penalising progress in a manner for which, sooner or later, the community at large would find itself paying very dearly. In this respect there is the lesson of the railways before us. The restrictive and obstructive policy of our predecessors can be felt to this very day, and has a good deal to do with the complaints that have been made against English railways in recent years. We do not want to repeat this error in our treatment of mechanical road transport, whether it be for passenger service or goods. Nevertheless, one must recognise that the views of local authorities should have due weight in regard to the traffic passing over their roads, and the crux of the problem is to combine this with adequate safeguards against mere prejudice operating to the detriment of public interests and convenience.

* * * * * *

There can be no more depressing task than that of calling attention to yet another matter in which the war has involved the country in a difficulty owing to the inclination to pursue a policy of drift in vital matters. The unpleasantness is modified, however, when an apparent earnest attempt to achieve a remedy can be pointed to on the part of so powerful a body

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MOTOR TRAFFIC.

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EARLY COMMERCIAL VEHICLES.

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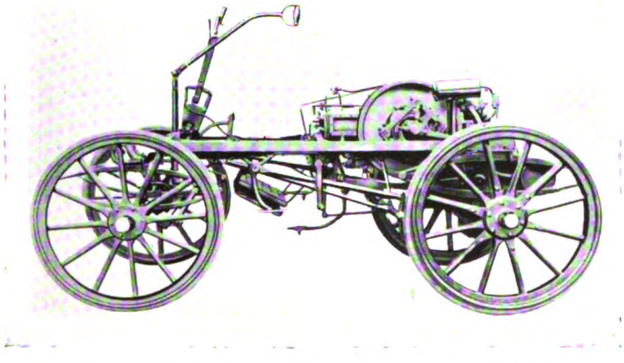
ALBION MOTOR CAR COMPANY.

From the Albion Motor Car Company, Scotstoun, Glasgow, we have received photographs of their first chassis and first commercial vehicle. The former was manufactured in 1899, and was of 8 H.P., steering being effected by the old-fashioned tiller, while there was an horizontal engine very nearly directly over the back axle. The first commercial Albion was made in 1900, being 8 H.P., taking a load of 10 cwts. in a box van body. After running on shop service for many years, this vehicle found a final resting place in the city of Glasgow Art Galleries, where it is viewed with much interest



8-h.p. Albion Chassis-Manufactured in 1899.

by many visitors from all parts of the world. As in 1899 pneumatic tires, as then constructed, were extremely unreliable and a constant source of trouble to motorists, the Albion Company decided to specially design a car which was capable of running on solid tires, and their efforts in this direction met with so much success that the company's output was always booked up many months ahead. Their vehicle then became known as " The Reliable Albion," which reputation the company have maintained to the present day. When once it had been proven that it was possible to construct a chassis for private purposes suitable for running on solid tires, it was only a natural step to further modify this vehicle so that it might be adapted for the conveyance of goods. This latter market developed very rapidly, and many well-known firms who, in the first instance, placed their order for one single machine, finding out in the course of time the great benefits of motor traction, placed repeated orders for large numbers of motor vehicles.

As time went on the general development of the motor car for private purposes and that for commercial purposes tended to become further apart, and called for greater specialisation in design. In order that the Albion Company might concentrate their whole attention to the ever-growing market for commercial vehicles, they decided about five years ago to confine their efforts entirely to the heavier side of motor manufacturing.

During the war the Albion Company's works have been entirely engaged in the supply of 3-ton war wagons to the Government, and so great has been the satisfaction obtained by those vehicles at the respective British fronts that at the special request of the War Department for increased output, considerable additions have been made to the works during the past two years. The output now is very large, and when once this country is in a position to resume normal trading again the Albion Company will be able to resume the supply of commercial motors to civilian users which will embody considerable improvements as the result of the unique

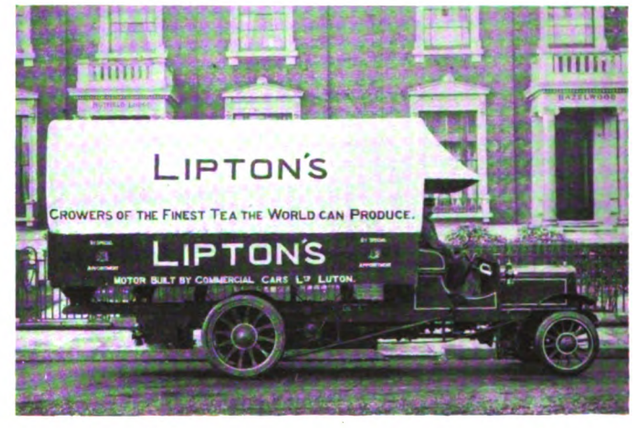
First Albion Commercial Vehicle: Built in 1900.

experience the company are obtaining through the severe tests their motor wagons have to enter under war conditions.

COMMERCIAL CARS, LIMITED.

One of the earliest companies to undertake the manufacture of general service vehicles was Commercial Cars, Limited, of Luton. The photograph below illustrates a 5-ton car sold by this company to Lipton, Limited, in 1908. This car won the silver medal in the R.A.C. liability trials in 1907, in the days when drivers thought it was desirable, even with a motor car, to negotiate a hill by taking a zig-zag course. A notable record has been compiled by this car, which is still running and it has now covered well over a 100,000 miles.

There are now several thousands of commercial vehicles manufactured by Commercial Cars, Ltd., in operation, and the company claim that since their first delivery to a user not a single one has been scrapped. Not only has a record been kept of every one delivered, but in the spare parts list of the various types which the company print and issue from time to time the number of every



5-ton Commer Car, Running Since 1908.

chassis is actually mentioned, so that the buyer of a secondhand commercial car can obtain a list and see exactly where it differs in any respect from another machine that comes under the same heading. Various users have at times asked for a different type of front axle or road wheels, and this is all clearly shown. Further,

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in the course of one particular year the company have made certain improvements in a particular model, and all this is shown. Any old "Commer car" can therefore always rise phœnix-like, as new parts in normal times can always be obtained; in fact the company does not like to call any of the many models they have turned out "old."

Traces of a few have been lost, but that doesn't mean that they have been scrapped. They are probably being used by some clever engineer who buys the parts from some Commercial Car agent, who naturally does not take the same interest in the car, and might have the part in stock without having to ask for the chassis number.

The company began their actual manufacture of vehicles for sale in August, 1906, at their factory, which had been erected on an expensive site at Luton, but for a year before that date the directors had secured a temporary workshop in London, where drawings and patterns were perfected in readiness for manufacture. The company came into existence because of the difficulty which was then experienced in obtaining vehicles for business purposes. Their activities now embrace all classes of business and public service vehicles, including fire escape carriers and first-aid vans.

DENNIS BROTHERS, LIMITED.

A study of the catalogues of Dennis Brothers, Limited, of Guildford, whose works were established in 1895, and have been enlarged on several occasions, affords an interesting history of the rise of the commercial vehicle and also of the Dennis turbine fire engine. In an early catalogue we notice a photograph of the first 1-ton worm-driven Dennis van, which was built in 1903, and was exhibited at the Crystal Palace the following year. An illustration is also given of a 2-ton van, purchased by Mr. Luxford, of Covent Garden, in 1904. It is still in service. A similar van was sold at the same time to Peak, Frean and Company.

The catalogue of 1903 shows that the Dennis patent worm gear, which was introduced in 1901, had proved the claims made for it by the makers as to quietness, durability, and effective drive. The success it had achieved induced the firm to give a two years' guarantee to this most important factor of a commercial or public service vehicle. Other advantages claimed for it was the greater reduction of ratio than it was possible to obtain with other types, and the reduction by one half of the wearing parts of the vehicle. The results led to the extensive adoption of Dennis chassis for omnibuses, as well as commercial vehicles, the Dennis machines being run in public service in London, the provinces, and abroad. We give an illustration of an early Dennis omnibus in service in the Thames valley.

An Early Dennis Omnibus.

In order to keep pace with the demand for their machines, Dennis Brothers had last year to erect a considerable number of dwelling-houses for their employees in the neighbourhood of Guildford. These are on model lines. One department of the company is a business in itself; we refer to the manufacture of fire extinguishing vehicles. More than two-thirds of the 150 motor machines in the possession of the London Fire Brigade were manufactured by Dennis Brothers.

THE DAIMLER COMPANY, LIMITED.

From the catalogue of the Daimler Company, Limited, of Coventry, for 1898, we reproduce a photograph of the original 6-H.P. Daimler delivery van. The vehicle won the first prize of £100 in the "trials of self-moving vehicles," which were carried out at the Birmingham Show of the Royal Agricultural Society of England in June, 1898.

6-h.p. Daimler Delivery Van—1898.

The vehicle was entered in the "light load class," and the judges were Mr. F. W. Webb, M.Inst.C.E. (Crewe), Mr. Bryan Donkin (London), and Professor Unwin (London). Its weight unloaded was 1 ton 3 cwts. 1 qr. 2 lb., and with two attendants 6 cwts. were added. With a load of 19 cwts. 1 qr. 14 lb., the total weight on the run of 53 miles was 2 tons 8 cwts. 2 qrs. 14 lb. The running time was 6 hours 3 minutes. The consumption of petrol was 2·81 gallons, cost of fuel for the journey 21·1d., cost of fuel per mile 0·45d., cost of fuel per ton per mile 0·18d., and cost of fuel per ton of cargo per mile 0·465d. At this interval of time the figures are of additional interest, particularly when it is added that the average speed did not reach nine miles an hour, while nowadays speeds exceeding 20 miles an hour are obtainable from heavy vehicles shod only with solid rubber tires. Even the radiator required 13 gallons of water for the journey.

As the run may be regarded as historic in the history of early commercial cars, it is of interest to quote the description of it from the judges' report:—"The van started from Bassett's Pole at 9.54 a.m., and again reached Bassett's Pole at 11.28¼ a.m. without a stoppage on the way. The net running time for the 13¼ miles was therefore 92¼ minutes, and the mean speed 8·62 miles per hour. From Bassett's Pole the van ran by Moxhull Corner to Fazeley and Atherstone, which was reached without a stop at 1.17 p.m. The net time for the distance of 15·75 miles was 110¾ minutes, and the mean speed 8·53 miles per hour. At Atherstone the van waited, by direction of the judges, till the other vans arrived, in order that they might see the behaviour of the cars on the steep inclines at Bentley. At 4.14½ p.m. the van started again

"Very satisfactory trials were made of starting, stopping, and backing on one of the steep inclines near Merevale Lodge, incline 1 in 9. The van then continued the journey, reaching Bassett's Pole at 6.51 p.m. The gross running time, deducting the ordered stoppage at Atherstone, was therefore 359½ minutes. There were no stoppages on the road, so that the net running time was 359½ minutes, and the mean speed for the whole run was 7·82 miles per hour. The motor was perfectly equal to the work set for it, and the run

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was effected with the greatest regularity and without a single hitch of any kind."

Since their triumph in that first trial of commercial vehicles, the achievements of the Daimler Company have continued to be in the forefront of the history of the motor movement, both as regards the private car and the business vehicle.

HALLEY'S INDUSTRIAL MOTORS, LIMITED.

A year ago our columns contained a review of "Halley History." This was the title of a 50-page publication issued by the company for the purpose of keeping their work before the eyes of home and colonial buyers during the time that the great resources of the works at Glasgow are helping to meet the war wants of the British Government and their Allies. The present occasion affords an opportunity of dealing with the company's early history and of introducing an illustration of the first petrol-driven commercial vehicle produced at their works. It is a 3-ton box van, and was purchased by Mr Milne, ice manufacturer, Glasgow. It is still in service, and has by this time traversed about 200,000 miles.

Halley's Motors, Limited, had the advantage of supplying the wants of business firms and municipalities with steam vehicles before they took up the manufacture of the petrol machine. The success of their steamers of 3 to 6 tons capacity, with trailers carrying from 2 to 4 tons, became firmly established between the years 1901 and 1905. Besides producing steam conveyances for industrial and colonial use, the company met the wants of local authorities in the matter of chassis fitted with interchangeable bodies for dust collecting, street watering, and sewer flushing. In the latter year the orders for steam wagons taxed the capability of the Crown Point Works to the utmost, and at this period many inquiries were reaching the firm for petrol vehicles from home users and from abroad. A design was therefore evolved, based on the experience obtained from the steam industry, and a number of vehicles were constructed. In 1906 the present works were opened at Yoker, Glasgow, the buildings now covering 160,000 square feet, and on the completion of the latest extension, in July, 1914, a further large area of ground adjoining was acquired. While in 1906 the number of employees was 100, to-day there are over 800, and the output has increased twenty-five fold.

The effect on the petrol machine of the company's experience as steam vehicle makers was seen when, in 1907, the Royal Automobile Club held their commercial vehicle trials. Halley entries secured the gold medal in the 2-ton class, the silver medal in the 30-cwt.

First Halley Petrol 3-ton Van.

class, and the special award for accessibility, simplicity, and freedom from liability to breakdown. The trials lasted six weeks in all weathers, and over roads that had been selected to afford an exhaustive test. So great became the demand for Halley vehicles that branch establishments were opened in Vauxhall Bridge Road, London, in Manchester, Liverpool, and Newcastle, and agencies in all the other principal cities at home as well as in Montreal, Melbourne, and Sydney. Based on the principles of reliability and durability, the Halley output continued to expand up to the outbreak of the war, and since August, 1914, the turnover has exceeded all records. The majority of the vehicles have been supplied to the Government for war purposes, and the company have also been permitted to execute a considerable number of civilian orders. It is in keeping with Halley history to learn that the Government departments have expressed appreciation with the manner in which the company have performed their contracts as a controlled firm. The experience in design and manufacture gained from the very exacting work executed during the war should enhance their reputation for sound engineering, with consequent benefit to customers whose orders are being booked for fulfilment after the war.

LEYLAND MOTORS, LIMITED.

The Royal Mail steam van herewith illustrated was the first road transport machine manufactured by Leyland Motors, Limited, of Leyland. Previous to 1895 the firm was engaged in the manufacture of steam lawn mowers, and the machine illustrated was really a direct development of this earlier industry. The steam generator consisted of an oil-fired vertical boiler about 2 ft. diameter

Leyland Oil-Fired Steam Van of 1895.

by 3 ft. long, and was fitted with a large number of vertical tapered fire tubes. The total heating surface was about 70 square feet, the working steam pressure being 200 lbs. per square inch.

The engine was of the vertical compound type, arranged immediately alongside the driver, and had cylinders of $2\frac{1}{2}$ in. diameter by 5 in. stroke high pressure and $4\frac{1}{4}$ in. diameter by 5 in. stroke low pressure, the engine running at a speed of about 550 revolutions per minute. A gear box with three speeds and reverse was fitted, the gears, which were loose upon the shaft, being engaged by means of spiral spring coil clutches, while the reverse was obtained by means of a chain drive. From the gear box a single chain led back to the compensatory shaft, which was carried across the frame in much the usual way; chain sprockets at each side transmitted the final drive to the road wheels. The road wheels were fitted with steel tires, and the machine was geared to run at speeds of 5, 10, and 15 miles per hour. The tare weight with light van body, as illustrated, came out at about 30 cwts.

While continuing to specialise in steam vehicles, which came into extensive use for industrial purposes at home and abroad, the company concurrently took up the manufacture of the petrol machine. They evolved types of engine and chassis that are now to be found in every class of petrol-propelled road vehicle used for freight, passenger, municipal, and fire extinguishing work. The fire engine class has proved of national service during the war, when many towns have equipped themselves with Leyland motor fire extinguishing plant as a protection against the risks of air raids.

Like their steam forerunner, the Leyland petrol motors have figured with distinction in official trials, and as far back as 1905 the Leyland omnibus had begun to take the prominent place it has since achieved in metropolitan, urban, and rural services. In that year the Company's two classes of prime mover had placed two prizes of £100 and nine gold and silver medals to their credit under the guidance of Mr. Henry Spurrier, jun., their originator, who had become the managing director. In the steam sphere they took the first award with the van (shown above) exhibited at the Royal Agricultural Show of 1897, while in 1898 they secured the first award (£100) for a 4-ton steam wagon. In the latter year the same machine gained the first prize of £100 in the series of trials on the road instituted by the Liverpool Self-propelled Traffic Association. The vehicle had an oil-fired boiler, and its performance was remarkable, the consumption of petroleum being ·56 gallon per vehicle mile, the water turned into steam measuring 3·4 gallons per mile. A similar wagon gained second award in the Association's trials, and in 1901 an improved coke-fired wagon, of under 3 tons, received a gold medal, the highest prize.

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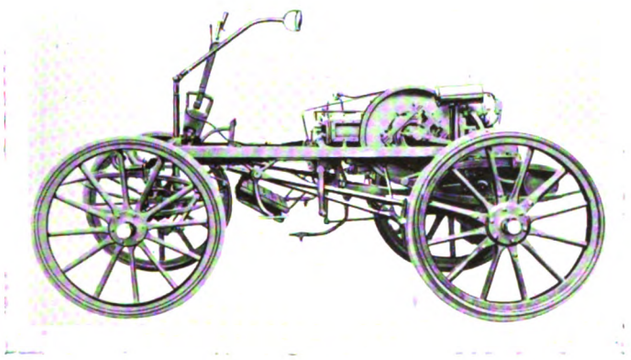
ALBION MOTOR CAR COMPANY.

From the Albion Motor Car Company, Scotstoun, Glasgow, we have received photographs of their first chassis and first commercial vehicle. The former was manufactured in 1899, and was of 8 H.P., steering being effected by the old-fashioned tiller, while there was an horizontal engine very nearly directly over the back axle. The first commercial Albion was made in 1900, being 8 H.P., taking a load of 10 cwts. in a box van body. After running on shop service for many years, this vehicle found a final resting place in the city of Glasgow Art Galleries, where it is viewed with much interest



8-h.p. Albion Chassis-Manufactured in 1899.

by many visitors from all parts of the world. As in 1899 pneumatic tires, as then constructed, were extremely unreliable and a constant source of trouble to motorists, the Albion Company decided to specially design a car which was capable of running on solid tires, and their efforts in this direction met with so much success that the company's output was always booked up many months ahead. Their vehicle then became known as "The Reliable Albion," which reputation the company have maintained to the present day. When once it had been proven that it was possible to construct a chassis for private purposes suitable for running on solid tires, it was only a natural step to further modify this vehicle so that it might be adapted for the conveyance of goods. This latter market developed very rapidly, and many well-known firms who, in the first instance, placed their order for one single machine, finding out in the course of time the great benefits of motor traction, placed repeated orders for large numbers of motor vehicles.

As time went on the general development of the motor car for private purposes and that for commercial purposes tended to become further apart, and called for greater specialisation in design. In order that the Albion Company might concentrate their whole attention to the ever-growing market for commercial vehicles, they decided about five years ago to confine their efforts entirely to the heavier side of motor manufacturing.

During the war the Albion Company's works have been entirely engaged in the supply of 3-ton war wagons to the Government, and so great has been the satisfaction obtained by those vehicles at the respective British fronts that at the special request of the War Department for increased output, considerable additions have been made to the works during the past two years. The output now is very large, and when once this country is in a position to resume normal trading again the Albion Company will be able to resume the supply of commercial motors to civilian users which will embody considerable improvements as the result of the unique

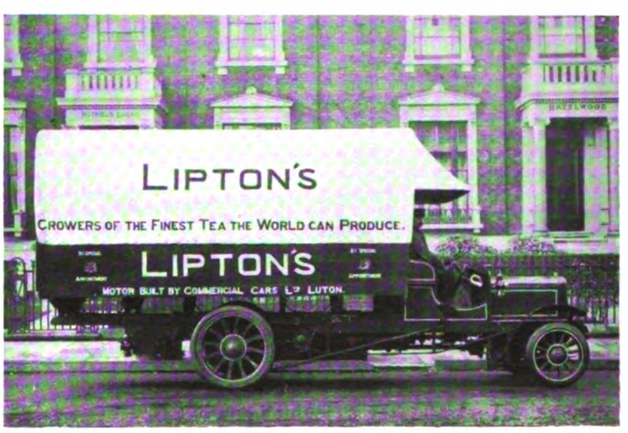
First Albion Commercial Vehicle: Built in 1900.

experience the company are obtaining through the severe tests their motor wagons have to enter under war conditions.

COMMERCIAL CARS, LIMITED.

One of the earliest companies to undertake the manufacture of general service vehicles was Commercial Cars, Limited, of Luton. The photograph below illustrates a 5-ton car sold by this company to Lipton, Limited, in 1908. This car won the silver medal in the R.A.C. liability trials in 1907, in the days when drivers thought it was desirable, even with a motor car, to negotiate a hill by taking a zig-zag course. A notable record has been compiled by this car, which is still running and it has now covered well over a 100,000 miles.

There are now several thousands of commercial vehicles manufactured by Commercial Cars, Ltd., in operation, and the company claim that since their first delivery to a user not a single one has been scrapped. Not only has a record been kept of every one delivered, but in the spare parts list of the various types which the company print and issue from time to time the number of every



5-ton Commer Car, Running Since 1908.

chassis is actually mentioned, so that the buyer of a secondhand commercial car can obtain a list and see exactly where it differs in any respect from another machine that comes under the same heading. Various users have at times asked for a different type of front axle or road wheels, and this is all clearly shown. Further,

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in the course of one particular year the company have made certain improvements in a particular model, and all this is shown. Any old "Commer car" can therefore always rise phœnix-like, as new parts in normal times can always be obtained; in fact the company does not like to call any of the many models they have turned out "old."

Traces of a few have been lost, but that doesn't mean that they have been scrapped. They are probably being used by some clever engineer who buys the parts from some Commercial Car agent, who naturally does not take the same interest in the car, and might have the part in stock without having to ask for the chassis number.

The company began their actual manufacture of vehicles for sale in August, 1906, at their factory, which had been erected on an expensive site at Luton, but for a year before that date the directors had secured a temporary workshop in London, where drawings and patterns were perfected in readiness for manufacture. The company came into existence because of the difficulty which was then experienced in obtaining vehicles for business purposes. Their activities now embrace all classes of business and public service vehicles, including fire escape carriers and first-aid vans.

DENNIS BROTHERS, LIMITED.

A study of the catalogues of Dennis Brothers, Limited, of Guildford, whose works were established in 1895, and have been enlarged on several occasions, affords an interesting history of the rise of the commercial vehicle and also of the Dennis turbine fire engine. In an early catalogue we notice a photograph of the first 1-ton worm-driven Dennis van, which was built in 1903, and was exhibited at the Crystal Palace the following year. An illustration is also given of a 2-ton van, purchased by Mr. Luxford, of Covent Garden, in 1904. It is still in service. A similar van was sold at the same time to Peak, Frean and Company.

The catalogue of 1903 shows that the Dennis patent worm gear, which was introduced in 1901, had proved the claims made for it by the makers as to quietness, durability, and effective drive. The success it had achieved induced the firm to give a two years' guarantee to this most important factor of a commercial or public service vehicle. Other advantages claimed for it was the greater reduction of ratio than it was possible to obtain with other types, and the reduction by one half of the wearing parts of the vehicle. The results led to the extensive adoption of Dennis chassis for omnibuses, as well as commercial vehicles, the Dennis machines being run in public service in London, the provinces, and abroad. We give an illustration of an early Dennis omnibus in service in the Thames valley.

An Early Dennis Omnibus.

In order to keep pace with the demand for their machines, Dennis Brothers had last year to erect a considerable number of dwelling-houses for their employees in the neighbourhood of Guildford. These are on model lines. One department of the company is a business in itself; we refer to the manufacture of fire extinguishing vehicles. More than two-thirds of the 150 motor machines in the possession of the London Fire Brigade were manufactured by Dennis Brothers.

THE DAIMLER COMPANY, LIMITED.

From the catalogue of the Daimler Company, Limited, of Coventry, for 1898, we reproduce a photograph of the original 6-H.P. Daimler delivery van. The vehicle won the first prize of £100 in the "trials of self-moving vehicles," which were carried out at the Birmingham Show of the Royal Agricultural Society of England in June, 1898.

6-h.p. Daimler Delivery Van—1898.

The vehicle was entered in the "light load class," and the judges were Mr. F. W. Webb, M.Inst.C.E. (Crewe), Mr. Bryan Donkin (London), and Professor Unwin (London). Its weight unloaded was 1 ton 3 cwts. 1 qr. 2 lb., and with two attendants 6 cwts. were added. With a load of 19 cwts. 1 qr. 14 lb., the total weight on the run of 53 miles was 2 tons 8 cwts. 2 qrs. 14 lb. The running time was 6 hours 3 minutes. The consumption of petrol was 2·81 gallons. cost of fuel for the journey 21·1d., cost of fuel per mile 0·45d., cost of fuel per ton per mile 0·18d., and cost of fuel per ton of cargo per mile 0·465d. At this interval of time the figures are of additional interest, particularly when it is added that the average speed did not reach nine miles an hour, while nowadays speeds exceeding 20 miles an hour are obtainable from heavy vehicles shod only with solid rubber tires. Even the radiator required 13 gallons of water for the journey.

As the run may be regarded as historic in the history of early commercial cars, it is of interest to quote the description of it from the judges' report:—"The van started from Bassett's Pole at 9.54 a.m., and again reached Bassett's Pole at 11.28¼ a.m. without a stoppage on the way. The net running time for the 13¼ miles was therefore 92¼ minutes, and the mean speed 8·62 miles per hour. From Bassett's Pole the van ran by Moxhull Corner to Fazeley and Atherstone, which was reached without a stop at 1.17 p.m. The net time for the distance of 15·75 miles was 110¾ minutes, and the mean speed 8·53 miles per hour. At Atherstone the van waited, by direction of the judges, till the other vans arrived, in order that they might see the behaviour of the cars on the steep inclines at Bentley. At 4.14½ p.m. the van started again

"Very satisfactory trials were made of starting, stopping, and backing on one of the steep inclines near Merevale Lodge, incline 1 in 9. The van then continued the journey, reaching Bassett's Pole at 6.51 p.m. The gross running time, deducting the ordered stoppage at Atherstone, was therefore 359½ minutes. There were no stoppages on the road, so that the net running time was 359½ minutes, and the mean speed for the whole run was 7·82 miles per hour. The motor was perfectly equal to the work set for it, and the run

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MOTOR TRAFFIC.

was effected with the greatest regularity and without a single hitch of any kind."

Since their triumph in that first trial of commercial vehicles, the achievements of the Daimler Company have continued to be in the forefront of the history of the motor movement, both as regards the private car and the business vehicle.

HALLEY'S INDUSTRIAL MOTORS, LIMITED.

A year ago our columns contained a review of "Halley History." This was the title of a 50-page publication issued by the company for the purpose of keeping their work before the eyes of home and colonial buyers during the time that the great resources of the works at Glasgow are helping to meet the war wants of the British Government and their Allies. The present occasion affords an opportunity of dealing with the company's early history and of introducing an illustration of the first petrol-driven commercial vehicle produced at their works. It is a 3-ton box van, and was purchased by Mr Milne, ice manufacturer, Glasgow. It is still in service, and has by this time traversed about 200,000 miles.

Halley's Motors, Limited, had the advantage of supplying the wants of business firms and municipalities with steam vehicles before they took up the manufacture of the petrol machine. The success of their steamers of 3 to 6 tons capacity, with trailers carrying from 2 to 4 tons, became firmly established between the years 1901 and 1905. Besides producing steam conveyances for industrial and colonial use, the company met the wants of local authorities in the matter of chassis fitted with interchangeable bodies for dust collecting, street watering, and sewer flushing. In the latter year the orders for steam wagons taxed the capability of the Crown Point Works to the utmost, and at this period many inquiries were reaching the firm for petrol vehicles from home users and from abroad. A design was therefore evolved, based on the experience obtained from the steam industry, and a number of vehicles were constructed. In 1906 the present works were opened at Yoker, Glasgow, the buildings now covering 160,000 square feet, and on the completion of the latest extension, in July, 1914, a further large area of ground adjoining was acquired. While in 1906 the number of employees was 100, to-day there are over 800, and the output has increased twenty-five fold.

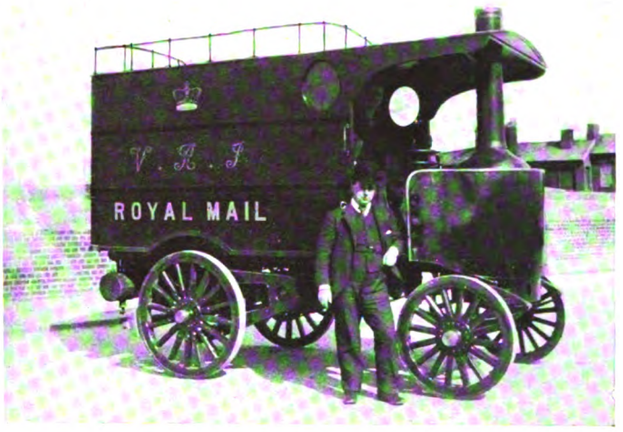
The effect on the petrol machine of the company's experience as steam vehicle makers was seen when, in 1907, the Royal Automobile Club held their commercial vehicle trials. Halley entries secured the gold medal in the 2-ton class, the silver medal in the 30-cwt.

First Halley Petrol 3-ton Van.

class, and the special award for accessibility, simplicity, and freedom from liability to breakdown. The trials lasted six weeks in all weathers, and over roads that had been selected to afford an exhaustive test. So great became the demand for Halley vehicles that branch establishments were opened in Vauxhall Bridge Road, London, in Manchester, Liverpool, and Newcastle, and agencies in all the other principal cities at home as well as in Montreal, Melbourne, and Sydney. Based on the principles of reliability and durability, the Halley output continued to expand up to the outbreak of the war, and since August, 1914, the turnover has exceeded all records. The majority of the vehicles have been supplied to the Government for war purposes, and the company have also been permitted to execute a considerable number of civilian orders. It is in keeping with Halley history to learn that the Government departments have expressed appreciation with the manner in which the company have performed their contracts as a controlled firm. The experience in design and manufacture gained from the very exacting work executed during the war should enhance their reputation for sound engineering, with consequent benefit to customers whose orders are being booked for fulfilment after the war.

LEYLAND MOTORS, LIMITED.

The Royal Mail steam van herewith illustrated was the first road transport machine manufactured by Leyland Motors, Limited, of Leyland. Previous to 1895 the firm was engaged in the manufacture of steam lawn mowers, and the machine illustrated was really a direct development of this earlier industry. The steam generator consisted of an oil-fired vertical boiler about 2 ft. diameter



Leyland Oil-Fired Steam Van of 1895.

by 3 ft. long, and was fitted with a large number of vertical tapered fire tubes. The total heating surface was about 70 square feet, the working steam pressure being 200 lbs. per square inch.

The engine was of the vertical compound type, arranged immediately alongside the driver, and had cylinders of $2\frac{1}{2}$ in. diameter by 5 in. stroke high pressure and $4\frac{1}{2}$ in. diameter by 5 in. stroke low pressure, the engine running at a speed of about 550 revolutions per minute. A gear box with three speeds and reverse was fitted, the gears, which were loose upon the shaft, being engaged by means of spiral spring coil clutches, while the reverse was obtained by means of a chain drive. From the gear box a single chain led back to the compensatory shaft, which was carried across the frame in much the usual way; chain sprockets at each side transmitted the final drive to the road wheels. The road wheels were fitted with steel tires, and the machine was geared to run at speeds of 5, 10, and 15 miles per hour. The tare weight with light van body, as illustrated, came out at about 30 cwts.

While continuing to specialise in steam vehicles, which came into extensive use for industrial purposes at home and abroad, the company concurrently took up the manufacture of the petrol machine. They evolved types of engine and chassis that are now to be found in every class of petrol-propelled road vehicle used for freight, passenger, municipal, and fire extinguishing work. The fire engine class has proved of national service during the war, when many towns have equipped themselves with Leyland motor fire extinguishing plant as a protection against the risks of air raids.

Like their steam forerunner, the Leyland petrol motors have figured with distinction in official trials, and as far back as 1905 the Leyland omnibus had begun to take the prominent place it has since achieved in metropolitan, urban, and rural services. In that year the Company's two classes of prime mover had placed two prizes of £100 and nine gold and silver medals to their credit under the guidance of Mr. Henry Spurrier, jun., their originator, who had become the managing director. In the steam sphere they took the first award with the van (shown above) exhibited at the Royal Agricultural Show of 1897, while in 1898 they secured the first award (£100) for a 4-ton steam wagon. In the latter year the same machine gained the first prize of £100 in the series of trials on the road instituted by the Liverpool Self-propelled Traffic Association. The vehicle had an oil-fired boiler, and its performance was remarkable, the consumption of petroleum being ·56 gallon per vehicle mile, the water turned into steam measuring 3·4 gallons per mile. A similar wagon gained second award in the Association's trials, and in 1901 an improved coke-fired wagon, of under 3 tons, received a gold medal, the highest prize.

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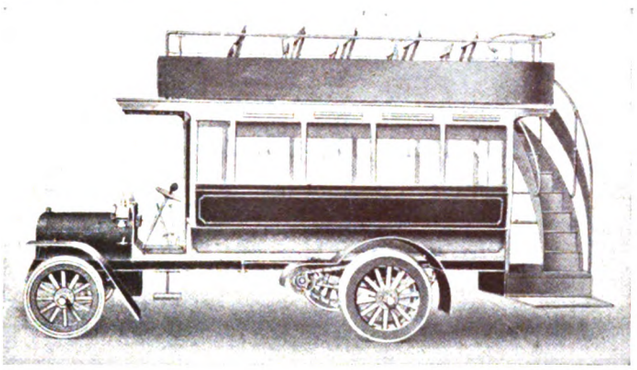
MOTOR TRAFFIC.

MAUDSLAY MOTOR COMPANY, LIMITED.

This Coventry establishment was one of the first to cater for public service and commercial needs. Their engines and chassis were designed on distinctive lines, the former being the subject of patents which were thoroughly tried out before being supplied to purchasers. The result was that in the early years of the final decade of last century the Maudslay vehicles had won reliability while some others had the reverse reputation, as instanced by the breakdown of London omnibuses. Maudslay machines passed through the trying test of public service in London, Edinburgh, and elsewhere triumphantly.

The foregoing fact is demonstrated by a glance at the company's catalogue. Thus in 1912 the London General Omnibus Company—themselves for some years past the largest manufacturers of omnibuses in the United Kingdom—informed the Maudslay Company



Maudslay Omnibus in Service at Edinburgh Since 1905.

that the six chassis purchased by the London Road Car Company in 1906 were still running. The joint manager of that time added :—"They gave every satisfaction, and as regards material and workmanship were equal to any that the combined undertakings, which are now the London General Omnibus Company, have used."

In 1912 also the Scottish Motor Traction Company gave the following verdict upon the working of eleven omnibus chassis delivered to them by the company between 1905 and 1909 :—"All are still in service, some of them running 130 miles per day, and the average annual mileage is 27,000 miles per vehicle. The routes are particularly hilly, and the road surfaces are nearly all macadam of varying qualities, so that it speaks well for the design, workmanship, and material of your machines to say that after all the work they have done they are still capable of giving satisfactory service. We have tried two other well-known makes of omnibus chassis, but neither have stood up to their work nearly so well as the 'Maudslay.' The design of your machine makes it particularly accessible for repairs. This is a most valuable feature in the commercial motor business, and as your new machines are even more accessible than your old ones, I have no hesitation in recommending them to users of industrial motors." Equally satisfactory testimony might be quoted from other users.

We append a photograph, published in the Motor Traffic Section of THE TRAMWAY AND RAILWAY WORLD of December, 1906, of one of the double-deck vehicles supplied to the Edinburgh Company. The machine was exhibited at the Royal Agricultural Hall Exhibition of 1906, when our comments anticipated the popularity that the type has now achieved. We observed that the vehicle exhibited was much more powerful than the single-deck omnibus for railway companies' purposes shown in 1905. Two of the new type had been ordered by the Edinburgh Company, which "hoped to build up a good business between the centre of the city and those suburbs, towns, and villages that are not reached by the cable tramways." That object has long since been accomplished. Reference was made to "the fact that the piston and connecting rods can be got at from the side of the crank chamber without disturbing the cylinders, removable doors being provided in the side of the crank chamber for the purpose." Our report added: "Regarding the valves, their position is such that any one of them can be removed and a new one fitted in a very few minutes. This is made possible by the use of a hinged layshaft."

It was only to be expected that so great an advantage would gain recognition in the Royal Automobile Club 22 days' trial in 1907. In that event a 3-ton Maudslay commercial vehicle was awarded a gold medal, while the War Office bestowed a diploma for the following special feature :—"The accessibility of the working parts of the 4-cylinder internal combustion engine fitted to their vehicle No. E40, which competed in the Royal Automobile Club vehicle trials, 1907." The importance of this feature is that treating the pistons one at a time the vehicle need never be taken out of service, whereas with an ordinary petrol engine similar work would be a two days' task.

Even in 1906 the total weight of the Maudslay double-deck omnibus, including body, as recorded in our columns, was only 4 tons 4 cwt. The Metropolitan Police regulations had not then been framed for the purpose of securing a reduction in the weight of the heavier and noisier vehicles then used in public service. Maudslay machines of every type have made continuous progress, but it would not be within the scope of this notice to deal with them here.

D. NAPIER AND SON, LIMITED.

The first business vehicle turned out by the above firm was delivered in the early part of 1901 to the M. Hyam Wholesale Clothing Company, Limited, at Colchester. A striking contrast is afforded by the photograph of that little box van when contrasted with the latest type of transport vehicle which Napiers have supplied in such large numbers to the British and Allied Governments during the war. A photograph of the former vehicle is herewith reproduced. Messrs. Hyam's van until recently was in service, and was capable of exceeding the 20-mile speed limit. Its chassis is somewhat similar to the chassis of the car that took part in the 1,000 miles reliability trials of the Automobile Club in 1903 The engine has the same dimensions, though the chain gearing is lower, and the vehicle is fitted with solid tires. The latest lorry shown in the other illustration carries loads of from 3½ to 4½ tons, and hundreds of the type have been constructed.

D. Napier and Sons' engineering works had been in existence for many years before the firm took up the manufacture of private and commercial motors. They were makers of gun and bullet making machinery, their works being in Vine Street, Lambeth, which district used to be the centre of the engineering industry in London. In 1841 they installed the first steam engine, gun finishing machinery, and bullet-making machinery in Woolwich Arsenal, where the motive power for machinery was at that period obtained by means of horses. The Napier Company's essay with the building of private business vehicles was made before they left the Lambeth works for the modern and extensive factory erected especially for

First Napier Commercial Vehicle, Date 1901.

the motor business at Acton. They were making a few 2-cylinder internal combustion motors in 1898, and in 1900 completed the first Napier car. This had an 8-H.P. 2-cylinder engine, of 4-in. bore, 6-in. stroke, the normal revolution being 800, and it was fitted with electric ignition by coil and accumulator, four-speed gear box, and pneumatic tires. Honours were gained by this car in the 1,000 miles trial, it beating some of the best 4-cylinder cars of other makes in several of the speed tests and hill climbs. As the result of the aforementioned run, the reputation of the Napier car was established, and from that time orders began to come in. Early in 1901 the 4-cylinder 16-H.P. Napier was produced, which had a large following, and did much by reason of its reliability and success in competition to develop the company's business.

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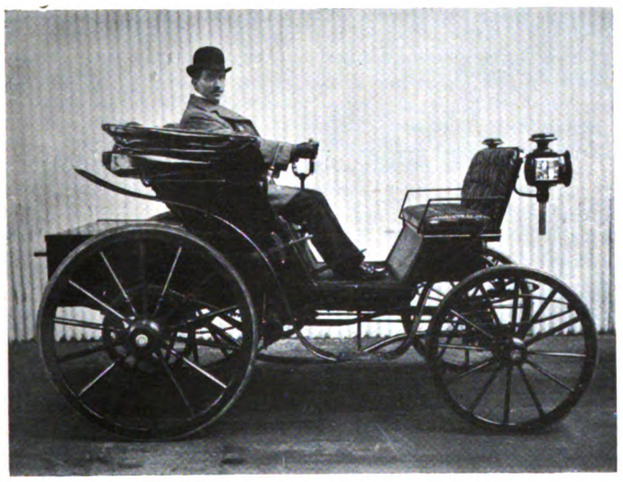
MOTOR TRAFFIC.

Foreseeing the great part that commercial motors were destined to take in the future trade of the country, the Napier Company in the same year devoted attention to that branch, but beyond working out sound lines of advance they were precluded by the limited area of the Lambeth works from taking a large part in it until recent years. During the interval laurels continued to be gained by the Napier private vehicle. In 1902 the 30-H.P. 4-cylinder machine, the first fitted with a live axle and driven by Mr. S. F. Edge, won the Gordon Bennet trophy, this being the only time that it was secured by an English-built car. In 1903 experiments were made with 6-cylinder motors, and at the Crystal Palace Show of 1904 the 6-cylinder Napier was exhibited No car in the history of the movement has had so much attention drawn to it, or achieved greater success. In 1907 the 24-hours' record was achieved on the 6-cylinder Napier on the Brooklands track, where many successes were subsequently scored until the influx of orders compelled the firm to devote their whole attention to the business side and gradually drop the racing side.

STRAKER-SQUIRE, LIMITED.

In turning to the well-known company of Straker-Squire, Limited, we come to a pioneer organisation in the general utility motor vehicle. From the Nelson Square, Blackfriars, S.E., premises, and the commodious provincial factory, an unceasing stream of machines has gone forth to business firms, public passenger transport undertakings, and to the sanitary and other departments of the municipalities.

The first of our illustrations of Straker-Squire products is a car that was constructed early in 1897 by Mr. Sidney Straker, who is an associate member of the Institution of Civil Engineers and a member of the Institution of Mechanical Engineers. From that time onward Mr. Straker has worked vigorously and successfully in the interests of both branches of the industry. He was one of the founders of the Royal Automobile Club, and in conjunction with the Hon. Arthur Stanley was mainly responsible for the inauguration of the annual exhibitions at Olympia under the auspices of the Society of Motor Manufacturers and Traders. Of that society he was president in 1904-5, 1905-6, and 1906-7. By their exhibitions, both in the private car and the business vehicle sections, the society

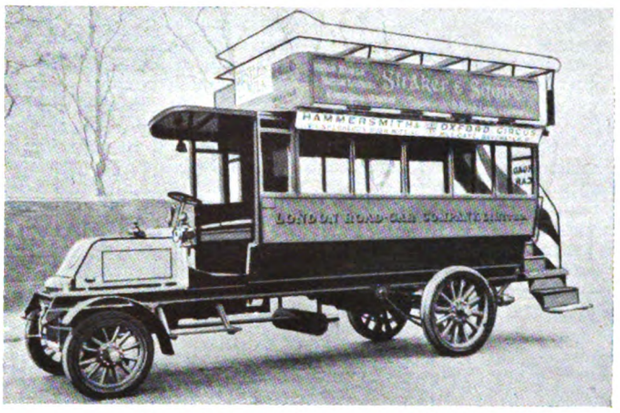


Straker Motor Car Built in 1897.

took the leading part in creating the demand which has developed with such remarkable rapidity.

Before glancing at the work of Straker-Squire, Limited, in the omnibus and lorry departments, it will be appropriate to mention that the reputation of the company in those directions has proved of invaluable service not only to the British Government during the war but to the Governments of our Allies. It is not permissible to reveal the total number of vehicles supplied to the British forces in the various theatres of war nor to the other Allies, but mention may be made that among the latter was a large order from the Russian Government for Straker-Squire standard "CO_4" lorries, which are constructed to carry a load of 4 tons, excluding the body. The importance of the motor vehicle to Russia may be inferred from the news that last year a road 600 miles in length was constructed between Archangel port and Petrograd to supplement the railway, and that a service of motor lorries is run thereon. It is important also to note that owing to the scarcity of labour and horses for municipal work the War Office have allowed the company to supply a number of their specialities for sanitary and other municipal work to the municipalities at home.

Great interest is attached to our photograph of the Straker-Squire type omnibus supplied to the London Road Car Company in the early years of petrol mechanical transport in the Metropolis. Owing to the efforts that were made to depreciate the value of the 2,000-mile trial early in 1905, under the auspices of the Royal A.C., on the ground that the conditions of the run did not represent the actual working conditions of a public service vehicle as regards



Straker-Squire Omnibus of 1905.

frequent stopping and starting, Straker-Squire, Limited, arranged with the London Road Car Company to put the vehicle illustrated into their service, and to observe and record its performance. The test began on March 9 on the route from Hammersmith to Oxford Circus, and ended on June 26, 1905, a period of 109 days, during which time 11,416 miles were run, or an average of 104·4 miles per day, the vehicle being driven after the first two weeks entirely by the omnibus company's men. It was a 24-H.P. chassis fitted with a 34-passenger body. At the conclusion of the trial the vehicle was exhibited at the Tramways Exhibition at the Royal Agricultural Hall, when the machinery was opened up and reported upon by Mr. Worby Beaumont.

The omnibus company's report showed that it had lost only one day's running, on March 20, for the purpose of adjusting the brakes. During the greater part of the 109 days the engine was running 17 hours a day, and Mr. Beaumont concluded his report with the following sentence:—"Considering the mileage, the condition of the whole of the parts is more than satisfactory. In making the mileage stated the engine and some of the gear and spindles have made approximately 50 millions of revolutions, and yet the gear in the secondary gear box and bevel gear still show the tool marks." Mr. Beaumont reported that he "examined the engine, the transmission and speed change gear, frame axles, brake gear, and the whole of the parts constituting the complete chassis. The whole of the parts were in a remarkably good condition, and the wear extremely small or negligible throughout considering the great distance run. Some renewals are required, including two pairs of change speed gear rings and ignition tappet spindles and some bearings on the change speed gear box, the whole cost of which I estimate at under £10."

Beyond the brake adjustment mentioned, nothing further was done to the vehicle during the trial. The wear found in the high speed gear wheels was very small in view of the fact that an omnibus is changing gear every few minutes owing to stoppages and traffic requirements. The following results, compiled by the omnibus company from the test, will be read with interest:—

Total mileage	11,416
Total passengers carried	95,968
Number of journeys	1,264
Petrol consumption in gallons	1,641
Miles to gallon of petrol	7
Lubricating oil in gallons	97
Miles to gallon of lubricating oil	118
Involuntary stops on road	Nil
Repairs during trial	Nil
Mr. Worby Beaumont's estimate for repairs desirable after trial	£10 0 0
Expenses for driver's wages, petrol, oil, cleaning, and repairs	£130 19 6
Or per car-mile	2¾d.
Cost of tires, as per contract, per car-mile	2d.
Total cost per car-mile (exclusive of depreciation, management, and conductor's wages	4¾d.

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MOTOR TRAFFIC.

In the year of the trial petrol wholesale cost only 6d. per gallon, as against 2s. 10d. per gallon paid at this stage of the war to the retailer. The latter sum includes the two taxes that have been placed on the spirit, totalling 1s. per gallon, and before the user can purchase it at all he has to pay 6d. per gallon to the Petrol Control Committee, as well as having obtained a licence to buy. The running expenses were £22 13s. for 224 journeys in March, £32 16s. for 365 journeys in April, £35 19s. 7d. for 393 journeys in May, and £29 0s. 11d. for 330 journeys in June.

JOHN I. THORNYCROFT AND COMPANY, LIMITED.

To this company belongs the distinction of having built the first commercial motor vehicle in existence in this country. It was completed before the 1896 Act came into force. In 1899 they sold their first motor lorry to the War Office, and it was used at the army manœuvres as an experiment. On the same occasion the Army Service Corps secured the loan of several Thornycroft steam lorries, which were just becoming well known, and in the following year the authorities obtained the loan of two 3-ton and a 6-ton Thornycroft steamers, which had been awarded the prize in the Liverpool Self-propelled Traffic Association's trials. Shortly afterwards ten 3-ton wagons were ordered for the A.S.C. In 1901 the War Office trials for the best motor wagon for military purposes resulted in a Thornycroft steam wagon and trailer securing the first prize of £500; the vehicles were purchased by the Government. A number of orders for similar ones were given by the War Office and by the Indian Government; and the Thornycroft and Foden vehicles,

Thornycroft Steam Omnibus of 1902.

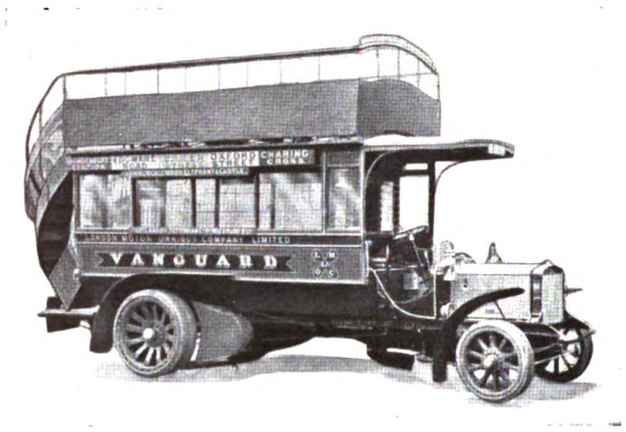
which had taken part in the trials, were shipped to South Africa for use in the Boer war.

The Thornycroft lorry was used to carry supplies along the line of blockhouses, and was frequently under fire. In a 16-page booklet entitled "What Thornycroft Motor Vehicles Have Done for the War Office," it is recorded that Lord Kitchener, in his evidence before the Royal Commission on the war in South Africa, stated:—"The motor lorries sent to South Africa did well; Thornycrofts are the best." A number of vehicles built to this War Office model, and supplied at that date, are doing good work at the present time.

Experiments were made in 1904 by the A.S.C. with 5-ton lorries driven by an internal combustion engine, using paraffin. The Thornycroft was one of the two selected designs, and the company have continued their close association with military transport work up to the present time, supplying many hundred vehicles to the army and other Government services.

The intervening twelve years have seen the rise of the petrol vehicle. In 1907 the R.A.C. 1,000 miles trial for commercial motors was made the more interesting by the War Office offer of certificates for vehicles using petroleum, the authorities still being afraid to use petrol for supply and ammunition wagons. Two Thornycroft paraffin lorries obtained the certificate, and further orders followed. In 1909 the company won the only award (£750) in the War Office trial for paraffin tractors, and gained orders for these vehicles fitted with rubber tires.

With the development of the rubber-tired petrol lorry for civil purposes the official opinion at last favoured a change. Then the War Office subsidy scheme was instituted to encourage business firms to purchase vehicles made to specifications laid down as the result of War Office trials. Thornycroft were one of the first two firms to enter vehicles. Their model—4-cylinder 30 H.P.—was



Thornycroft in use in London.

accepted, and the machine that went through the competition was purchased by Messrs. Pickford, Limited. As the result of further trials the celebrated Thornycroft 40-H.P. 4½-ton "J" type of wagon, suitable for civil and military work, was designed. It is described as an ideal commercial lorry to carry 3½ tons. The chassis can be adapted to run on kerosene, ensuring a large saving in fuel.

Concurrently with their army work, Thornycrofts were pioneers in the production of vehicles for civil use, including public passenger work. The latter aspect is indicated by the two accompanying photographs of omnibuses, the steam vehicle being in use in London before the introduction of rubber tires.

"KARRIER" LORRY WITH A FRAGILE LOAD.

At the present price of eggs, this 2½-ton Karrier lorry has a very valuable load. One would have thought eggs to be too fragile to be

conveyed by a motor lorry. So evidently the springing of the 'Karrier" shown in the photograph must be nicely adjusted to absorb excessive vibration.

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MOTOR TRAFFIC.

MOTOR COMPANIES IN 1916.

JOHN I. THORNYCROFT AND COMPANY, LIMITED.—At the annual meeting of shareholders of John I. Thornycroft and Company, Limited, in London, Mr. John E. Thornycroft said the work being done was now four times that of pre-war times, and the board felt justified in paying 10 per cent. on the ordinary shares.

SCOTTISH MOTOR TRACTION COMPANY.—The net profit for the year ended September 30, after writing off expense of the recent issue of capital and transferring £2,000 to reserve fund, amounted to £6,560, and £2,119 was brought forward. A dividend is proposed of 7½ per cent. free of income-tax, carrying forward £2,142.

D. NAPIER AND SON, LIMITED.—At the annual meeting of this company at the Acton Works on December 29, Mr. M. S. Napier presided, and moved the adoption of the report for the year ended September 30 last. In it the directors stated that the profit, after allowing for depreciation, etc., amounted to £76,856, to which is added the balance brought forward from last account, £9,839. After deducting expenditure in dividends, etc., there is a balance of £50,557. The directors recommended a dividend of 6 per cent., less income-tax, on the ordinary shares, the placing to general reserve a further £20,000, and the carrying forward to next year a balance of £9,557. (For 1913-14 the ordinary dividend was 3 per cent., and for 1914-15 five per cent. was paid.) The chairman said that the improvement in the results compared with the previous year had been effected by increased output, notwithstanding the difficulties in obtaining deliveries of materials and the higher cost of such materials and labour. Practically the whole of the output had been supplied to the British and Allied Governments. They would appreciate that the value of orders in hand was considerable from the fact that the deposits received against such orders was wholly responsible for the increase in the item in the accounts for creditors and credit balances, compared with the previous year. The company was also fortunate in having a good stock of material. The company were still engaged in the development and manufacture of special aero engines for the Government, a class of work which called for the greatest care and skill in construction. Mr. H. T. Vane, managing director, in seconding, expressed appreciation of the manner in which the staff and employees had put forth their energies to do their part in this European conflict, as the particular war work on which the company was engaged called not only for long hours and close attention, but a keen interest. The experience gained in this class of work should be of great benefit to the future. After the war he hoped that the Government would recognise the necessity for protecting the British motor trade, to enable the companies to arrange their works in order to regain and improve their position, and not allow the foreign manufacturer to step in and take what rightly belonged to the British manufacturers who were devoting their energies to help to win the war.

NATIONAL STEAM CAR COMPANY.—Mr. T. Clarkson presided at the annual meeting on December 29, when the following report was presented for the year ended October 31:—"The profit, after making provision for maintenance, depreciation, etc., is £52,379. Of this sum £19,500 has been placed to the special reserve for the renewal of omnibuses, £9,309 applied to special writings off, and out of the balance of £23,570 the directors recommend a dividend of 10 per cent. This will absorb £15,750, leaving, with the amount brought forward of £4,405, a total of £12,225 to carry forward, against which there is special taxation of which the amount has not yet been ascertained. The fleet of omnibuses has been maintained in the highest possible state of efficiency, having regard to the special conditions prevailing on account of the war, the average number licensed during the year being 160. The coke-motor lorries manufactured by the company have further demonstrated their economical working, and in order to provide increased facilities for their manufacture the board propose to increase the capital by £100,000." The chairman observed that the result of the year's working constituted a record in their history. Both the result of the omnibus service and the working of the factory had been profitable. The works had been controlled under the Ministry of Munitions Act, and had contributed towards the increase in the production of munitions of war, besides which they had been engaged partly in the construction of coke-motor chassis and in turning out spare parts for the London and Chelmsford fleet and for customers who were running their steam lorries. The shareholders had probably seen the reports of bath caravans for giving warm baths to the troops. The caravans were equipped with a Clarkson boiler and burner as used on the National omnibuses. The boiler and burner is the most powerful apparatus for its weight and size for the rapid production of hot water. He had the honour of demonstrating the working at Buckingham Palace to the King and Queen, who showed great interest therein.—At an extraordinary general meeting the capital was authorised to be increased by £100,000 in order to undertake the manufacture of coke-fired vehicles.

HALLEY'S INDUSTRIAL MOTORS, LIMITED.—At the annual meeting Mr. Jackson Millar presided, and moved the adoption of the report, which stated that the net profits, including £3,800 brought forward, amounted to £31,546. A final dividend of 5 per cent. and a bonus of 1s. per share, free of tax, were proposed, making 15 per cent. for the twleve months, and leaving £15,726 to be carried forward. The chairman stated that out of the profits for 1915 they placed to special reserve account against payments for excess profits the sum of £25,000. This they found, when the exact liability under the Finance Act was ascertained, was not sufficient, and they had therefore to take a considerable sum from the "carry forward," which had consequently entailed a much reduced amount being brought into the past year's accounts. The actual amount so brought in was £3,800. The profit for the past year at £27,745 was less than for the previous year, principally due to delivering a considerable number of vehicles by special Government permission to civilian customers, and which were booked at pre-war prices, but owing to the long period of delay between booking the orders and the time when they, by Government permission, could give delivery, they had to be manufactured out of material bought at war prices and with labour getting war wages. These orders taken at pre-war prices were now, however, all delivered, and he had no doubt whatever that the smaller margin of profit was far more than counterbalanced by the opportunity it gave them of maintaining their connection and name. Further, the profit of £27,745 was a net profit. It was arrived at after making full provision for income-tax, for ample depreciation, and also for liabilities under the excess profits tax and Munitions of War Act. The factory was very fully employed with Government work, and they had contracts with the various Government departments which, so far as they could see, would continue until the close of the war. As a controlled firm, it was not advisable, even if it were permissible, to tell them very much regarding their many activities as regards Government work, but he could tell them that the directors felt quite satisfied as regards the future of the company. Mr. Halley seconded the motion for the adoption of the report, and said they had been kept at full pressure. He denied a rumour that the company had lost certain Government contracts. They had never had an expression of dissatisfaction. On the contrary, they had had several expressions of appreciation from Government departments, both verbally and in writing, not alone as regards the quality of the goods, but the manner in which such contracts have been carried out.

"JITNEY" CARS IN BRITISH COLUMBIA.

The continuance of the competition of jitney cars with the British Columbia Electric Railway is referred to in the report of the directors for the year ended June 30 last. That severe competition, the directors state, together with the reduction in the population and the reduced spending capacity of the citizens and the greatly increased cost of supplies, were responsible for the decrease in the revenue, and in order to pay the dividend on the 5 per cent. cumulative preference stock the reserve fund had had to be drawn on. Since January 1 the jitney competition had been less acute than in the previous year, but it was estimated that these cars are still depriving the company of earnings amounting to approximately 350,000 dollars a year. About 35,000 soldiers had left British Columbia for overseas service, of whom probably about 25,000 had left the territory served by the company, and a further large number of people more or less dependent on them had also left. As compared with the year 1914, the population served by the company was estimated to have decreased by 30 per cent.

In the speech of Mr. Horne-Payne, the chairman, which was read at the annual meeting on December 22, he said:—"This company has deserved well of the people of British Columbia, and was entitled to expect not only fair treatment, but every encouragement, and in this matter of competition they certainly have not received it. Every effort has been made to obtain fair treatment by endeavouring to secure that the jitneys shall be subject to similar control of service, accommodation, and construction of cars and other matters as is imposed upon the company, and that they shall contribute to municipal revenue and expenses in some fair proportion to the contribution of this company. But it has as yet been impossible to convince the authorities and the public of the folly of maintaining by preferential treatment (to the detriment of a great enterprise, which has done in the past and can do in the future so much for the province) a service which is merely a convenience to a certain section of the public, and can do nothing to advance permanently the general welfare, by the expenditure of capital, the employment of labour, or the encouragement of industries."

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MOTOR TRAFFIC.

MOTOR TRAFFIC NOTES.

TIRES FOR RAILLESS TROLLEY CARS. The Dunlop Rubber Company have a contract to supply solid rubber tires for the railless trolley cars of the Bradford tramways department for a period of two years.

ROAD TRAIN FOR ASYLUM STORES.—The Metropolitan Asylums Board, who recently agreed to purchase a steam tractor and trailers for the conveyance of stores, have now ordered a second tractor and trailers. It is intended to haul coal from the railway sidings to the asylums.

DIFFICULTY OF OBTAINING VEHICLES.—Owing to the temporary prohibition by the Ministry of Munitions of the construction of motor vehicles for civil use, the Ilford Urban Council have been unable to purchase a motor chassis. An appeal to the Local Government Board for assistance brought a reply from the president that on the facts presented he could not intervene.

THE PETROL-PROPELLED CAR AT STIRLING. In his remarks at the annual meeting of the Stirling and Bridge of Allan Tramways Company, the chairman (Mr. H. F. Brand) referred to the heavy increase in the cost of working the horse-drawn cars, and added that the petrol car, which was introduced a few years ago, was more lucrative to the company than the horse cars.

MOTOR TRADE'S PATRIOTIC GIFT.—The Society of Motor Manufacturers and Traders has handed over to the Union Jack Club (extension fund) the sum of £1,302 10s., being the amount received in response to the appeal issued by the president of the society, Mr. Edward Powell, plus a contribution of £100 by the society. The club provides quarters for sailors and soldiers arriving in London.

CHARGE FOR NEW OMNIBUS ROUTES. -The Southdown Motor Services have informed the Westhampnett Rural Council that they cannot pay the charge of 3d. per mile which it is proposed to levy on new services in West Sussex, and they have decided to withdraw the service. A similar refusal has been made by the Aldershot and District Traction Company relative to a service between Midhurst and Chichester.

BERNA CHASSIS.—Owners of Swiss " Berna " chassis are requested to communicate at once with the British Berna Motor Lorries, Limited, Avonmore Road, West Kensington, London, W., giving particulars of Ministry of Munitions priority number and class, if any, issued for the maintenance of their vehicles. Unless this is done, it will be impossible under existing conditions to guarantee the maintenance of these vecicles.

SHORTAGE OF LONDON AMBULANCE DRIVERS.—The Metropolitan Asylums Board on January 6 complained of a shortage of drivers for their motor ambulances owing to enlistments. A member stated that there were hundreds of A.S.C. wagons driving about London empty. While the latter statement is exaggerated, there would appear to be room for making some use of the numerous empty wagons that are used for the instruction of army motor drivers.

MOTOR WAGONS FOR SALE AT CARDIFF. -The chairman of the Public Works Committee at Cardiff has stated that one-third of the staff had been displaced since August, 1914. The department at present employed six steam rollers and a petrol roller, and the committee were prepared to sell some of them and the motor wagons. They were doing all the repairs to the streets they could, but there would be no great renewals on account of the shortage of material and men.

MOTOR PRISON VANS.—While many provincial Municipalities have purchased motor prison vans, the Metropolitan police continue to use the high, lumbering, pair-horse vans that constitute the most obstructive traffic unit in the streets of London. It is time that Scotland Yard and the Home Office took a lesson in this and other matters from the more progressive authorities in the provinces. Plymouth is the latest Corporation to obtain a motor vehicle for the conveyance of prisoners.

OMNIBUS TRAFFIC ON A RURAL ROAD.—Since the Court of King's Bench decided against them in the action for damages for wear of a rural road by their omnibuses, the Oxford Tramways Company have changed the route of their vehicles in the Abingdon Rural Council's district. The route to Abingdon is now entirely on the main roads belonging to the County Council, but the change is not relished by the residents at Boars Hill, at whose instance the service was run, for they now have a mile or more to walk. The damages awarded to Abingdon Council work out at 3¼d. per car-mile of the omnibuses and chars-a-bancs.

OMNIBUSES SUGGESTED FOR SOUTHAMPTON.—During a discussion by Southampton Corporation of the need for an increase in the tramway service to Shirley, Councillor Tebbutt suggested that the Tramways Committee should consider the advisability of adopting motor omnibuses. He asserted that the ordinary traffic of the town was continually interfered with by the tramcars. Omnibuses could be made adaptable to the varying needs of the districts. The Council requested the committee to consider the question of improving the service to Shirley.

MANUFACTURE OF ELECTRIC VEHICLES.—As a result of correspondence between the Electric Vehicle Committee and the Ministry of Munitions, a tentative arrangement has been agreed to by the latter under which the firm at present manufacturing electric vehicles in this country will be allowed, for the time being, to manufacture such vehicles for purposes of urgent national importance The firms, however, are required to apply for a permit in the case of each order that they desire to put through their shops. The firms referred to are Messrs. Ransomes, Sims and Jefferies, Limited, of Ipswich, Messrs. Edison Accumulators, Limited, of London, Messrs. Electromobile (Leeds), Limited, of Leeds, and Messrs. Richard Garrett and Sons, of Leiston, Suffolk.

MOTOR VEHICLES FOR MUNICIPALITIES.

DARLINGTON STREETS COMMITTEE have been authorised to order a motor wagon.

BARNSLEY COUNCIL are considering the question of obtaining a motor fire engine.

TYNEMOUTH TOWN COUNCIL have resolved to purchase a motor fire engine out of revenue.

GLOUCESTER WATCH COMMITTEE have advised the Corporation to obtain a second motor fire engine.

LONGFORD COUNTY COUNCIL have advanced £200, free of interest, to the surveyor, to enable him to purchase a motor car.

CARLISLE COUNCIL have agreed to the purchase of an electric vehicle for the removal of refuse and for general carting.

WOLVERHAMPTON COUNCIL have ordered an Orwell electric lorry of 2½-tons capacity from Messrs. Ransomes, Sims and Jefferies.

SURBITON URBAN COUNCIL have placed an order with Edison Accumulators, Limited, for two battery-propelled dust vans, at £1,025 each.

SALFORD COUNCIL have ordered an Orwell battery-driven wagon from Mossay and Company, Limited, for the use of the Electricity Department, at £795.

DENNIS BROTHERS, LIMITED, have a contract to supply a 75-H.P. motor turbine fire engine with 55-ft. lattice girder fire escape to Bradford Corporation, at £1,300.

SHEFFIELD CORPORATION have decided to add five more battery-propelled vehicles to their fleet of motor conveyances for the collection of refuse. The estimated cost is £5,500.

THE MAYOR OF SALFORD is to be provided with a motor car by the Town Council. It is to be a 45-H.P. 6-cylinder Daimler, to cost £1,200. Only three members voted against the purchase.

GLASGOW CORPORATION recently took delivery of one of two Edison battery vehicles for refuse collection. The superintendent of the cleansing department has reported that the vehicle is giving entire satisfaction.

OMNIBUSES SUGGESTED FOR READING.—The Tramways Committee of Reading recently recommended the purchase of three double-deck Tilling-Stevens petrol-electric omnibuses, in order to institute a service to Caversham Heights. The Corporation did not adopt the proposal.

BOLTON ELECTRICITY COMMITTEE, besides considering the advisability of acquiring an electrically-propelled vehicle for the use of the department, are empowered to confer with the several committees of the Corporation using horse or other vehicles as to the desirability of substituting electrical vehicles.

LONDON GENERAL OMNIBUS CHANGES.

Mr. W. J. Iden, chief engineer to the London General Omnibus Company, has resigned that position in order to accept an appointment with an important engineering company in the North of England.

Mr. George J. Shave has been appointed chief engineer of the London General Omnibus Company, in succession to Mr. Walter Iden, who has resigned. Mr. Shave has a thorough and practical knowledge of the engineering department of this important undertaking, having had charge of the company's extensive works at Walthamstow prior to his appointment as chief assistant to Mr. Iden in 1913.

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THE Tramway & Railway World
WITH MOTOR TRAFFIC SECTION

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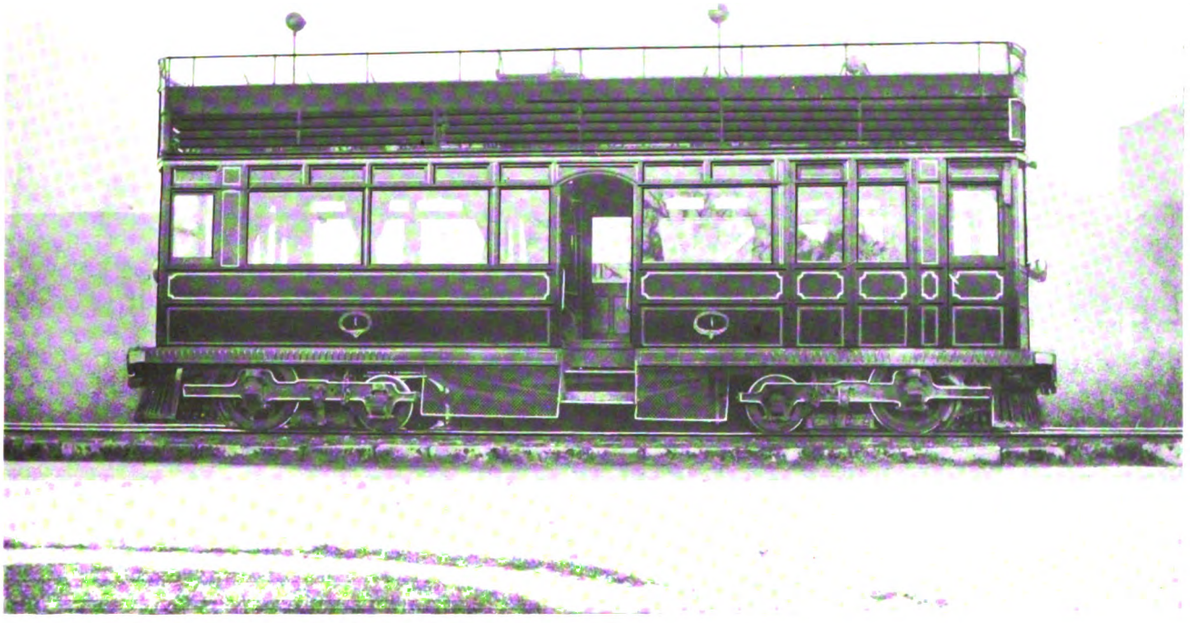
PETROL-ELECTRIC CARS ON THE DUBLIN AND BLESSINGTON TRAMWAY.

DESIGNED FOR OPERATION UNDER THEIR OWN POWER OR FROM THE TRAMWAY CIRCUIT.

The Dublin and Blessington Tramway Company have in service between Terenure and Poulaphouca two self-propelled cars of the petrol-electric type. These cars were constructed by Messrs. Hurst, Nelson and Company, of Motherwell, to the design of the company's consulting electrical engineer, Mr. J. P. Tierney, M.I.E.E. The electrical equipment was supplied by the British Westinghouse Electric and Manufacturing Company, Manchester, and the petrol engines by the Aster Engineering Company, Wembley.



Petrol-Electric Car—Dublin and Blessington Tramway.

The conditions presented a considerable number of difficulties, all of which gave trouble in designing the cars. It had to be borne in mind that they should be capable of operating both by the Blessington Tramway under their own power, and over the lines of the Dublin United Tramways Company, from Terenure to Nelson Pillar, on trolley power. Under the Acts of Parliament of the latter company only electrically-propelled cars are authorised to operate over certain sections of this route. In addition, the cars had to comply with the Irish Metropolitan Police regulations. Double-deck cars are very popular with the Dublin public, and it was therefore of importance that this type should be adopted. With the exception of certain cars on the Hastings Tramways, these are the first self-propelled double-deck cars that have been designed for operation under their own power and under trolley power. The idea of complying with these conditions was to provide a through service from the centre of the city to the various points on the Blessington Tramway.

The cars are of unusual construction, in which the centre entrance principle has for the first time been made use of for petrol-electric cars in Great Britain. The car is of the double-truck, double-deck type, and is divided into first and third class compartments. The compartments are placed on either side of the entrance, the generator compartment being at one and a driver's compartment at the other end of the car. The upper deck is also divided into first and third class, which are placed on either side of the central stairway. The cars are 33 ft. long over the

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body, and provide seating capacity for 72 passengers, of which 26 are inside and 46 on the top deck. The underframe is constructed entirely of steel and is fitted with D and B type central buffing and draw-gear, and substantial cow life-guards are provided.

Trucks.—The trucks are of the bogie maximum traction swing bolster type, fitted with 33-in. driving wheels and 23-in. pony wheels, and were constructed by Messrs. Hurst, Nelson and Company. On the driving axle of each truck is fitted a Westinghouse No. 230 500-volt standard series railway motor. The capacity of this motor is 65 H.P. It drives on to the car axle through the ordinary single reduction gearing, the gear ratio being 16 to 69; this is the lowest gear ratio possible with this motor, and was necessitated by reason of the very heavy grades on the Blessington Road. The trucks are fitted with the ordinary stand hand brakes working on all wheels, and in addition with the Westinghouse magnetic track brake, consisting of two track brake magnets on each truck. These latter are independent of the hand brake gear and are of the maximum length permitted by the wheel base of the trucks, it being desirable to get the most powerful brake possible on account of the very bad grades.

Generating Equipment.—The generating equipment consists of the Aster petrol engine of the vertical multi-cylinder type. The six cylinders are in line, are cast in pairs, and are mounted on a cast-iron crank chamber which carries the bearings. The timing gears are enclosed in an oil-tight casing at the forward end of the engine. The tappets are fitted with rollers, have adjustable tops, and are enclosed by an oil-tight door, which ensures the engine being clean in operation. The engine is completely enclosed.

Water Circulation is by a geared plunger pump mounted on the engine. The water is fed into the jackets on both sides of the engine opposite the valve pockets, and is discharged through the covers at the top of the cylinders. From there it is delivered to a small tank in the roof of the car, thence to a special pipe radiator, from there returning to the engine.

Lubrication.—Forced lubrication is employed by means of a gear-type oil pump mounted on the generator end of the crank case and driven off the exhaust cam shaft; this supplies lubrication to all the bearings and moving parts of the engine. A governor of the centrifugal type is mounted on the spindle driving the magneto. This is for the purpose of preventing damage to the engine in the event of the load being suddenly removed with the carburettor throttle left full open. The governor operates a throttle which is separate from the carburettor throttles, these being operated by the driver's controller. There are two carburettors of the Claudel-Hobson type feeding in parallel into one common induction pipe.

Ignition.—Two means of ignition are provided—one, the high-tension magneto, the other, accumulator ignition with a single coil through a high-tension distributor. The latter is used for starting and as a standby to the magneto. Each system has its own set of sparking plugs.

Generator.—The engine is direct-connected to a Westinghouse 65-KW., 300 to 600 volts, shunt-wound interpole, 4-pole generator; this supplies current for traction purposes only. The poles of this generator are all connected to a small starting controller, so that the generator field coils can be connected all in parallel when the generator is being used as a motor to start up the petrol engine or connected in series when running under ordinary circumstances and supplying current to the car motors. The generator is fitted with ball bearings and is of special design, in order to reduce its overall length as much as possible and so accommodate the generating set within the width of the car allowed by the city police regulations. The speed of the set is 1,150 revolutions per minute.

Lighting.—The current for the lighting of the car and its trailers is supplied when running from a shunt-wound lighting generator, 1½-KW. at 32 volts, running at 1,900 revolutions per minute, which is belt-driven off the main set and is mounted on top of the power generator. In addition there is a battery of 16 accumulators supplied by the D.P. Battery Company, having a capacity of 20 amperes for four hours, for the purpose of lighting the train when the main set is shut down or turning slowly when standing at stations. This battery is charged off the lighting generator when running, and it is also arranged to supply current to the main generator when this is used as a motor for starting the petrol engine. The usual automatic cut-out is provided, which cuts out the lighting generator and cuts in the battery when the speed of the generating set falls below a certain point. The first class compartment is lighted by four small holophane globes mounted at the back of the seats on ornamental brackets. The third class compartment is lighted by two similar units and two large holophane hemisphere bowls mounted on the car roof. Lamps are provided over the conductor's platform and in the engine compartment. The top of the car is lighted with four bulkhead lights mounted on roof. In addition, there is the usual electric head light and red tail light. Couplar sockets and jumper cables are provided for conveying current to the trailer cars, each of which is lighted inside by eight 20-watt lamps on brackets and two bulkhead deck fittings on top.

System of Control.—The control apparatus is similar on both ends of the car, to permit of the car being operated from either end. It consists of the following:

Petrol-electric driving controller.
Trolley driving and braking controller.
Hand brake spindle.
Foot gong.
Electric horn.
Bell push for signalling to conductor.
Sand gear pedal.
Combined ammeter, voltmeter, and wattmeter.

In addition to the above in the engine compartment is a small starting controller for starting the generating set.

Petrol-electric Driving Controller.—This is very similar to the ordinary standard tramway controller. The controller contains 24 driving positions, for 12 of which the car motors are connected in series, while they are in parallel for the others. No starting resistance is used in the motor circuits; resistance is inserted by the operation of this controller in the field circuit of the main traction generator.

The portion of the controller handle which the motorman holds in his hand is free to move about two inches along the handle proper; this movement regulates the throttle of the petrol engine. The handle is so arranged that if the motorman takes his hand off it, it automatically flies back to its outward position, in which the throttle of the engine is nearly closed, only enough mixture being admitted to keep the main generating set turning slowly round. This ensures that the engine is always throttled down before the load is thrown off the generator, and also acts as a dead man's handle in cases of accident to the motorman, the power being thereby cut off the car. The method of driving is as follows:—

The controller handle is first put on the position which gives full field to the main generator and the car motors connected in series. The main set is then slowly turning round. The controller handle is then

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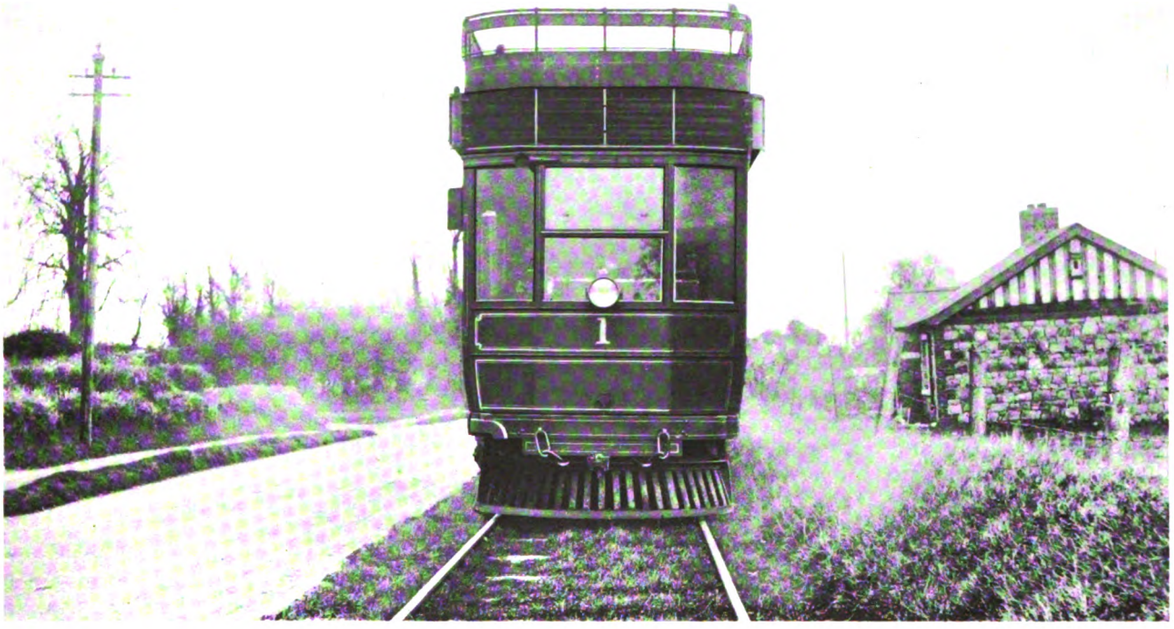
moved slowly along the main part of the handle; this opens the throttle of the petrol engine, which then accelerates. As it does so, the voltage of the generator increases, the current in amperes for the car motors increases, and the car subsequently speeds up. As soon as the voltage of the generator reaches 500, the controller handle is thrown on to one of the parallel positions, which gives the generator a reduced field and therefore lower terminal volts, but the voltage is then straight across each motor and not divided between the two as in the series position. As the car accelerates the current in amperes falls and the voltage of the generator rises; resistance is then gradually cut out of the field circuit of the generator, each reduction in resistance causing the terminal voltage to increase and the car to accelerate. This is continued up to the point when full kilowatt load is being generated by the set. When running on the level the generator is operated with the highest field possible, with the car motors in parallel, and so maximum speed is obtained. When ascending a grade the car motors are connected in series and the generator operated at a low field, so that it is then generating its full kilowatts with a heavy current in amperes and a small terminal voltage. The motors being in series, the total current generated is available for tractive effort in both motors. By this means, on grades a big drawbar pull is obtained at a low speed without overloading the generating set, and at the same time, on the level, full kilowatts are obtained by a low current in amperes, high terminal volts, and consequently high speed of the car.

The above describes the complete method of control when working on the petrol-electric system, and by its means a large variety of what is practically electrical gears possessing the maximum flexibility and the minimum of wear and tear is obtained.

Trolley Controller.—This is an ordinary series-parallel tramway-type controller, and contains the usual series and parallel positions for the car motors. The controller has four series power notches, and three parallel power notches, and in addition seven brake notches. The magnetic brakes are operated by this controller when the car is driven from its own generating set, and when it is driven off a trolley line. The two controllers are mechanically interlocked, so as to prevent the brake being applied until power is cut off, and likewise to prevent power being applied until the brake is brought to the off position.

The small starting controller mounted in the engine compartment is for the purpose of connecting the lighting battery with the main traction generator to drive the latter as a motor, and so speed up the petrol engine; in other words, it acts as an electric self-starter. When this is done the four field coils of the generator are connected in parallel to get the necessary starting torque, because the generator is wound for 500 volts and the storage battery only gives 32 volts.

With this arrangement the petrol engine always fires in about two seconds from the starting controller being operated. The starting controller is operated by the motorman's reversing handle. By this means it is impossible for the motorman to start his car until this starting controller is in the off position. It is thereby ensured that the field coils of the generator are properly connected in series, and the storage battery completely disconnected from the power circuits. In order to secure easy starting conditions the engine is provided with a half compression attachment which is changed to full compression as soon as the engine is started up.



Front View of Petrol-Electric Car on Sleeper Track Laid beside the Highway.

The Hand-brake Spindle and Foot Gong are of the usual standard type used on electric cars, likewise the sand gear, both rails being sanded at either end.

The Electric Horn is operated by a small bell push in front of the motorman, which obtains its current from the lighting storage battery.

A small slate switchboard is mounted in the engine compartment, containing a circuit breaker in the circuit between the storage battery and the starting controller to protect the former; a cut-out for the purpose of cutting in the battery when the lighting generator volts fall; a small field rheostat for regulating the charging volts when the battery is being

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charged: an ammeter, a voltmeter, and three switches all on the lighting circuit of the car and trailer plug sockets.

The motorman's driving instrument deserves special notice; it is a combined ammeter, voltmeter, and wattmeter, and is circular in shape with three scales, the ammeter scale covering one half of the circumference of the face of the instrument, and the voltmeter covering the other half. Pointers controlled by the respective coils work on each scale. A kilowatt scale marked in straight lines across the face of the instrument is in the centre. The two pointers work across one another, and the intersecting point between the two pointers indicates on the kilowatt scale the kilowatts being generated by the set. This instrument is a very correct grade indicator, and it is by its aid that the motorman gets the best results out of his car.

Radiators.—The conditions of radiators are particularly difficult, because for about three miles the grade of the road averages 1 in 31, on which section the engine is naturally exerting its full power, the speed of the car is lowest, and the conditions of radiation most difficult. The radiator consists of a copper pipe 1 in. in diameter, on which is wound a spiral gill, the outside diameter of the gill being $3\frac{1}{8}$ in. This pipe is carried for six turns completely round the outside of the side boards on the top of the car, as shown in the illustrations. It was not possible to utilise the roof owing to the car being double decked.

The car is fitted with the usual draw gear and coupling chains for trailers.

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ONE-MAN CARS IN AMERICA.

The one-man car—that is, the car which has no conductor and is under the sole charge of the driver—has been tried only to a very limited extent in this country. The object is to provide a small, light, easily-handled car capable of being run at low cost. Obviously it would be of no use for heavy city traffic; it is, indeed, intended for quiet routes and routes of moderate travel. Not only is its field thus limited, but in this country there is the further difficulty of the graded fare. Where there is only one fare for any distance, the passenger can simply drop his fare in a box on entering, and if necessary get change from the driver. But the driver could not collect graded fares and issue tickets while attending to his own work. There is no reason, however, why the one-man car should not develop in suitable localities where a uniform fare for any distance can be charged.

In the United States, where uniform fares are the rule, and where tramways have been pushed more into semi-rural or rural districts of light traffic, there is a very considerable field for one-man cars, and to some extent it has been developed. Details have recently been given by the *Electric Railway Journal*, of New York, of one instance in which such cars have been used with much success for the past three years. The Illinois traction system, which includes a number of electric tramways and light railways in the State of Illinois, was suffering from motor omnibus competition, while at the same time the management wished to furnish a more frequent service of cars at a lower working cost. The company accordingly ordered a number of one-man cars. These vehicles seat thirty-seven people and weigh 23,500 lb., so that they not only reduce platform cost but furnish a seating capacity equivalent even to some double-truck cars. Moreover, the reduction in weight decreases energy consumption, overhead and track maintenance. Aside from these features, there were incorporated in the car equipment safety appliances consisting of a dead man's control, air-operated doors and steps and an emergency rear door, all so arranged that the car cannot be started when the doors and steps are open, and the doors and steps cannot be opened when the car is in motion. As a result the cars have proved to be as safe as any type operated by two men, and the past three years' experience with them has been thoroughly satisfactory from an operating standpoint.

The general design, being of the one-man type, is arranged for single-end operation, with exit and entrance doors at the front and an emergency exit door at the rear. The car floor is continuous through the car body and vestibules. The body is arranged in two compartments, namely, the main passenger compartment at the front end of the car, where space is provided for the entrance and exit of passengers as well as for the motorman, and a smoking compartment occupying the rear vestibule, the latter being separated from the main passenger compartment by a bulkhead fitted with a sliding door. Longitudinal seats are provided in the main passenger compartment, and there are seats along the sides and round the end of the rear vestibule, except for an aisle to the emergency door. The general dimensions are as follows:—

Length overall, 32 ft. 4 in.
Height from top of rail to top of trolley, 10 ft. $9\frac{5}{8}$ in.
Height from rail to car body floor, 28 in.
Height from rail to top of first step, 14 in.
Height from first step to car body floor, 14 in.
Distance between side posts, 2 ft. $3\frac{1}{2}$ in.
Width of car over side plates, 8 ft. 2 in.
Gauge of track, 5 ft.

The underframing of the car, which was greatly simplified by the omission of drop platforms, includes side sills that consist of $\frac{3}{8}$ in. by $2\frac{1}{2}$ in. by 3 in. angles running in one continuous length from buffer to buffer, and offset at one side for the exit and entrance doors in the front vestibule and for the rear emergency door. The two cross-bearers in the centre of the underframe and those at the vestibule corner posts are formed of 3 in., 5·5 lb. I-beams. The next set of cross-bearers to those in the centre of the underframe are 3 in., $7\frac{1}{2}$ lb. I-beams, and those at the body corner posts are 4 in., $7\frac{1}{2}$ lb. I-beams. Diagonal bracing in the two vestibule panels of the underframe is provided by two $\frac{1}{8}$ in. by 3 in. by 3 in. angles. The underframe is of the side girder type, and the girders are formed of $\frac{1}{8}$ in. by 32 in. plates reinforced at the top by $\frac{3}{8}$ in. by 3 in. belt-rails which extend the full length of the girder.

The posts are of ash mortised into long-leaf yellow pine sills, which are bolted to the steel underframe. Each post is securely bolted to the girders by four $\frac{3}{8}$ in. turned-head carriage bolts. Plates are installed and these also are of long-leaf yellow pine, and they are mortised for top-post tenons. The letterboard is made of poplar dapped over the side posts, to which it is securely glued and screwed. The arm rails are made of ash dapped over the side posts, and the outside of the vestibules below the windows is covered with

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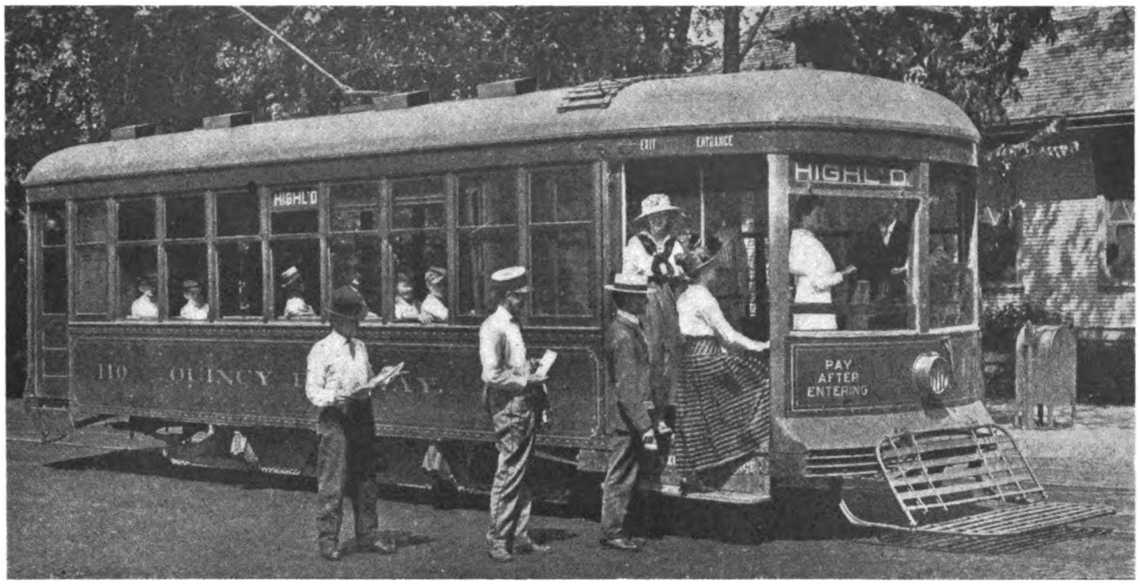
No. 14 gauge steel. The roof is of the plain-arch type and of wooden construction, except over each side post, where it is reinforced with a $\frac{3}{8}$ in. by $1\frac{3}{4}$ in. steel carline.

Mahogany of a plain design is used for an interior finish. The ceilings are formed of three-ply poplar veneer, the sashes are of mahogany, and the hardware is highly polished bronze. The seats are of the longitudinal type, and they are upholstered in rattan.

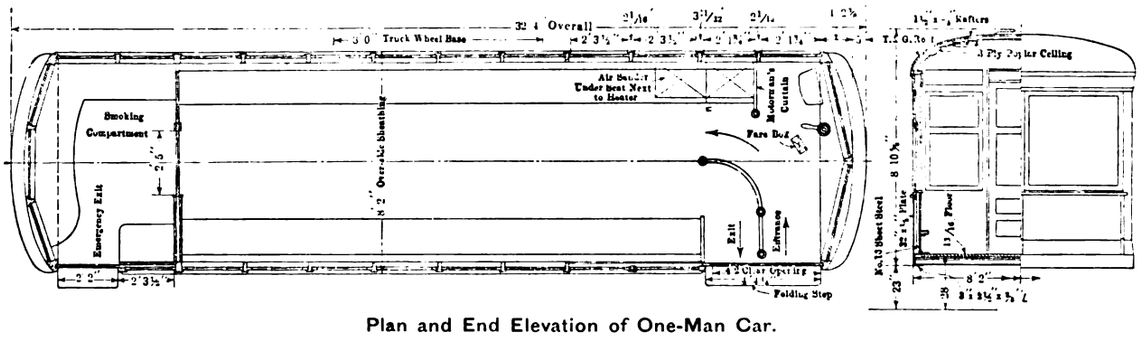


One-Man Car—Illinois Traction Company.

A single truck of special design has been provided for the car, the bottom member of the truck frame being formed of $\frac{1}{2}$ in. by 3 in. by 3 in. angles, and the top member of $\frac{1}{2}$ in. by 4 in. by 4 in. angle. Four elliptic springs are mounted on the four outside corners of the truck frame, and these carry the body. The journal-box yokes are arranged to permit the wheels to be removed in an ordinary drop pit, and longitudinal motion of the car body is limited by providing a dampener between the truck frame and one of the body underframe cross-bearers. Similarly, coil springs are provided in conjunction with the elliptic springs to obviate unnecessary vertical movement. The truck is fitted with 28 in. wheels, and has an 8 ft. wheelbase. The motors are Westinghouse type 328.

Undoubtedly the most interesting features of the car are included in the provisions to make its operation by one man safe under all conditions. These features include air-operated doors and steps so arranged that the car cannot be started when the doors and steps are open, and they in turn cannot be opened when the car is in motion. Since doors and steps were to be interlocked with the brake system, the Westinghouse Traction Brake Company was requested to develop a brake apparatus which would also operate the doors and steps and sand the rail in one operation. The object of the combined apparatus is to reduce the number of handles to be actuated by the motorman. The brake valve has been arranged not only to supply air pressure to the brake apparatus in the usual way, but to supply air pressure to the front door operating cylinder, and also includes a feature which enables the motorman to sand the rails, merely by depressing the brake-valve handle.

In normal operation the plan is to control only the front door and step in addition to the air brakes by means of the brake-valve. The rear door is intended for an emergency exit, and its operation is controlled by an emergency valve and not directly by the brake-valve. On any occasion which produces an emergency action of this valve, an emergency application of the air brake is made, and the front and rear doors and steps open. After such an application of the emergency valve a pause of approximately twenty seconds is required before release of the brake and doors can be effected. In order to avoid holding the front and rear doors open for that period of time in disagreeable weather, a cut-out cock with a side vent has been installed in the motorman's cab adjacent to the brake-valve, which, if operated, will serve to release and close the doors and steps, but this in no way affects the air brakes. Emergency operation may be caused in four different ways—by placing the brake-valve handle in



Plan and End Elevation of One-Man Car.

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body, and provide seating capacity for 72 passengers, of which 26 are inside and 46 on the top deck. The underframe is constructed entirely of steel and is fitted with D and B type central buffing and draw-gear, and substantial cow life-guards are provided.

Trucks.—The trucks are of the bogie maximum traction swing bolster type, fitted with 33-in. driving wheels and 23-in. pony wheels, and were constructed by Messrs. Hurst, Nelson and Company. On the driving axle of each truck is fitted a Westinghouse No. 230 500-volt standard series railway motor. The capacity of this motor is 65 H.P. It drives on to the car axle through the ordinary single reduction gearing, the gear ratio being 16 to 69; this is the lowest gear ratio possible with this motor, and was necessitated by reason of the very heavy grades on the Blessington Road. The trucks are fitted with the ordinary stand hand brakes working on all wheels, and in addition with the Westinghouse magnetic track brake, consisting of two track brake magnets on each truck. These latter are independent of the hand brake gear and are of the maximum length permitted by the wheel base of the trucks, it being desirable to get the most powerful brake possible on account of the very bad grades.

Generating Equipment.—The generating equipment consists of the Aster petrol engine of the vertical multi-cylinder type. The six cylinders are in line, are cast in pairs, and are mounted on a cast-iron crank chamber which carries the bearings. The timing gears are enclosed in an oil-tight casing at the forward end of the engine. The tappets are fitted with rollers, have adjustable tops, and are enclosed by an oil-tight door, which ensures the engine being clean in operation. The engine is completely enclosed.

Water Circulation is by a geared plunger pump mounted on the engine. The water is fed into the jackets on both sides of the engine opposite the valve pockets, and is discharged through the covers at the top of the cylinders. From there it is delivered to a small tank in the roof of the car, thence to a special pipe radiator, from there returning to the engine.

Lubrication.—Forced lubrication is employed by means of a gear-type oil pump mounted on the generator end of the crank case and driven off the exhaust cam shaft; this supplies lubrication to all the bearings and moving parts of the engine. A governor of the centrifugal type is mounted on the spindle driving the magneto. This is for the purpose of preventing damage to the engine in the event of the load being suddenly removed with the carburettor throttle left full open. The governor operates a throttle which is separate from the carburettor throttles, these being operated by the driver's controller. There are two carburettors of the Claudel-Hobson type feeding in parallel into one common induction pipe.

Ignition.—Two means of ignition are provided—one, the high-tension magneto, the other, accumulator ignition with a single coil through a high-tension distributor. The latter is used for starting and as a standby to the magneto. Each system has its own set of sparking plugs.

Generator.—The engine is direct-connected to a Westinghouse 65-KW., 300 to 600 volts, shunt-wound interpole, 4-pole generator; this supplies current for traction purposes only. The poles of this generator are all connected to a small starting controller, so that the generator field coils can be connected all in parallel when the generator is being used as a motor to start up the petrol engine or connected in series when running under ordinary circumstances and supplying current to the car motors. The generator is fitted with ball bearings and is of special design, in order to reduce its overall length as much as possible and so accommodate the generating set within the width of the car allowed by the city police regulations. The speed of the set is 1,150 revolutions per minute.

Lighting.—The current for the lighting of the car and its trailers is supplied when running from a shunt-wound lighting generator, 1½-KW. at 32 volts, running at 1,900 revolutions per minute, which is belt-driven off the main set and is mounted on top of the power generator. In addition there is a battery of 16 accumulators supplied by the D.P. Battery Company, having a capacity of 20 amperes for four hours, for the purpose of lighting the train when the main set is shut down or turning slowly when standing at stations. This battery is charged off the lighting generator when running, and it is also arranged to supply current to the main generator when this is used as a motor for starting the petrol engine. The usual automatic cut-out is provided, which cuts out the lighting generator and cuts in the battery when the speed of the generating set falls below a certain point. The first class compartment is lighted by four small holophane globes mounted at the back of the seats on ornamental brackets. The third class compartment is lighted by two similar units and two large holophane hemisphere bowls mounted on the car roof. Lamps are provided over the conductor's platform and in the engine compartment. The top of the car is lighted with four bulkhead lights mounted on roof. In addition, there is the usual electric head light and red tail light. Couplar sockets and jumper cables are provided for conveying current to the trailer cars, each of which is lighted inside by eight 20-watt lamps on brackets and two bulkhead deck fittings on top.

System of Control.—The control apparatus is similar on both ends of the car, to permit of the car being operated from either end. It consists of the following:

Petrol-electric driving controller.
Trolley driving and braking controller.
Hand brake spindle.
Foot gong.
Electric horn.
Bell push for signalling to conductor.
Sand gear pedal.
Combined ammeter, voltmeter, and wattmeter.

In addition to the above in the engine compartment is a small starting controller for starting the generating set.

Petrol-electric Driving Controller.—This is very similar to the ordinary standard tramway controller. The controller contains 24 driving positions, for 12 of which the car motors are connected in series, while they are in parallel for the others. No starting resistance is used in the motor circuits; resistance is inserted by the operation of this controller in the field circuit of the main traction generator.

The portion of the controller handle which the motorman holds in his hand is free to move about two inches along the handle proper; this movement regulates the throttle of the petrol engine. The handle is so arranged that if the motorman takes his hand off it, it automatically flies back to its outward position, in which the throttle of the engine is nearly closed, only enough mixture being admitted to keep the main generating set turning slowly round. This ensures that the engine is always throttled down before the load is thrown off the generator, and also acts as a dead man's handle in cases of accident to the motorman, the power being thereby cut off the car. The method of driving is as follows:—

The controller handle is first put on the position which gives full field to the main generator and the car motors connected in series. The main set is then slowly turning round. The controller handle is then

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moved slowly along the main part of the handle; this opens the throttle of the petrol engine, which then accelerates. As it does so, the voltage of the generator increases, the current in amperes for the car motors increases, and the car subsequently speeds up. As soon as the voltage of the generator reaches 500, the controller handle is thrown on to one of the parallel positions, which gives the generator a reduced field and therefore lower terminal volts, but the voltage is then straight across each motor and not divided between the two as in the series position. As the car accelerates the current in amperes falls and the voltage of the generator rises; resistance is then gradually cut out of the field circuit of the generator, each reduction in resistance causing the terminal voltage to increase and the car to accelerate. This is continued up to the point when full kilowatt load is being generated by the set. When running on the level the generator is operated with the highest field possible, with the car motors in parallel, and so maximum speed is obtained. When ascending a grade the car motors are connected in series and the generator operated at a low field, so that it is then generating its full kilowatts with a heavy current in amperes and a small terminal voltage. The motors being in series, the total current generated is available for tractive effort in both motors. By this means, on grades a big drawbar pull is obtained at a low speed without overloading the generating set, and at the same time, on the level, full kilowatts are obtained by a low current in amperes, high terminal volts, and consequently high speed of the car.

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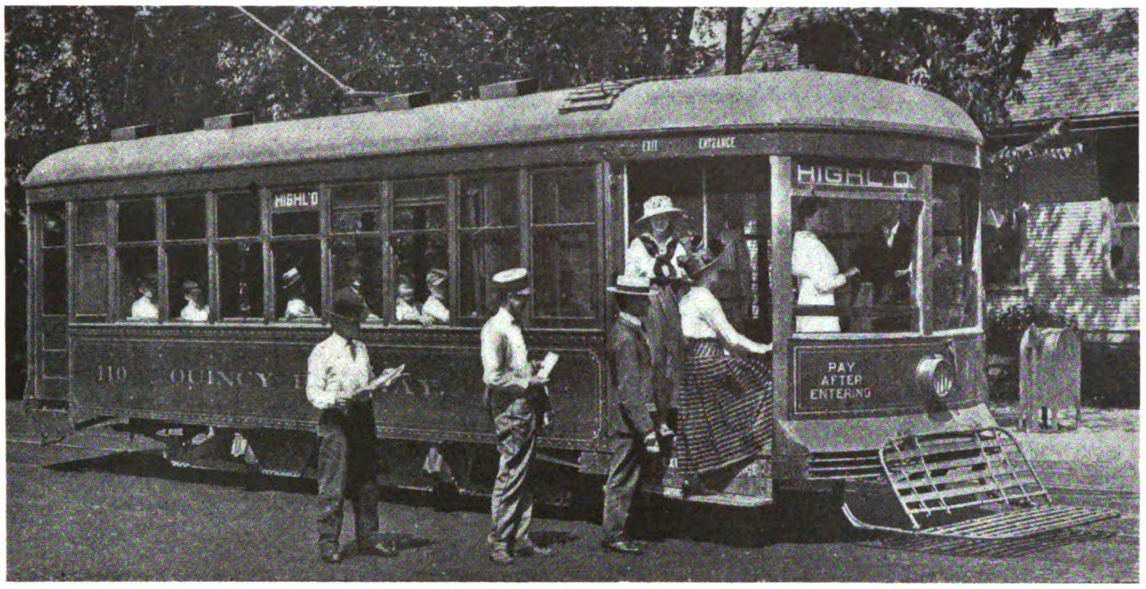
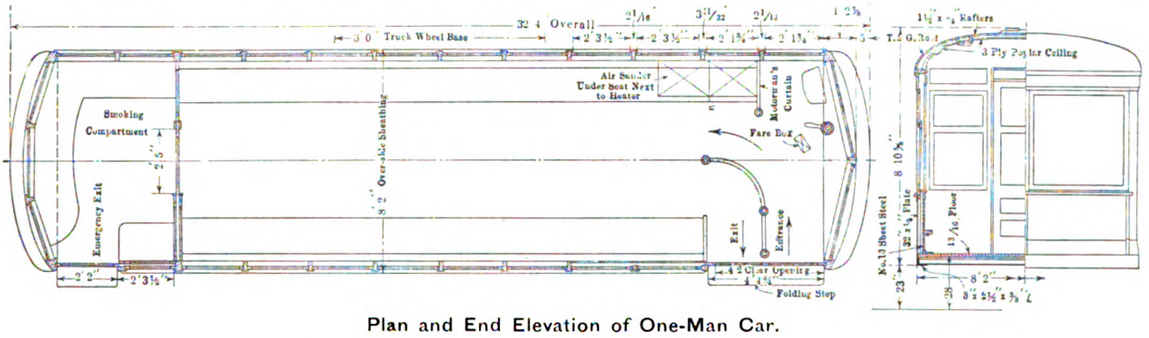


One-Man Car—Illinois Traction Company.

A single truck of special design has been provided for the car, the bottom member of the truck frame being formed of $\frac{1}{2}$ in. by 3 in. by 3 in. angles, and the top member of $\frac{1}{2}$ in. by 4 in. by 4 in. angle. Four elliptic springs are mounted on the four outside corners of the truck frame, and these carry the body. The journal-box yokes are arranged to permit the wheels to be removed in an ordinary drop pit, and longitudinal motion of the car body is limited by providing a dampener between the truck frame and one of the body underframe cross-bearers. Similarly, coil springs are provided in conjunction with the elliptic springs to obviate unnecessary vertical movement. The truck is fitted with 28 in. wheels, and has an 8 ft. wheelbase. The motors are Westinghouse type 328.

Undoubtedly the most interesting features of the car are included in the provisions to make its operation by one man safe under all conditions. These features include air-operated doors and steps so arranged that the car cannot be started when the doors and steps are open, and they in turn cannot be opened when the car is in motion. Since doors and steps were to be interlocked with the brake system, the Westinghouse Traction Brake Company was requested to develop a brake apparatus which would also operate the doors and steps and sand the rail in one operation. The object of the combined apparatus is to reduce the number of handles to be actuated by the motorman. The brake valve has been arranged not only to supply air pressure to the brake apparatus in the usual way, but to supply air pressure to the front door operating cylinder, and also includes a feature which enables the motorman to sand the rails, merely by depressing the brake-valve handle.

In normal operation the plan is to control only the front door and step in addition to the air brakes by means of the brake-valve. The rear door is intended for an emergency exit, and its operation is controlled by an emergency valve and not directly by the brake-valve. On any occasion which produces an emergency action of this valve, an emergency application of the air brake is made, and the front and rear doors and steps open. After such an application of the emergency valve a pause of approximately twenty seconds is required before release of the brake and doors can be effected. In order to avoid holding the front and rear doors open for that period of time in disagreeable weather, a cut-out cock with a side vent has been installed in the motorman's cab adjacent to the brake-valve, which, if operated, will serve to release and close the doors and steps, but this in no way affects the air brakes. Emergency operation may be caused in four different ways—by placing the brake-valve handle in



Plan and End Elevation of One-Man Car.

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the emergency position; by removing the hand from the controller handle while in a feeding position; by opening the conductor's valve; or by a rupture in the air brake piping system.

Safety under all operating conditions was the motive which also governed the design of the door-operating mechanism. When the front door is opened the step drops quickly, and it is in the lowered position by the time the door is opened 12 in. or 14 in. Any additional travel of the door toward its open position does not affect the step, and consequently when it is being closed the door will travel to within 12 in. or 14 in. of its closed position before the step is raised. The general operation of the rear-door mechanism and step is similar to that of the front door step, except that the rear door is automatically fastened shut so that it cannot easily be opened by hand.

Since these cars began running in August, 1913, experience has proved the equipment satisfactory from every standpoint. The cars have thoroughly established their reliability and economy, and the knowledge gained in their operation has led to the development of a still lighter car designed on the same principles.

At a recent meeting in Chicago of the Illinois Electric Railway Association two papers were read on the operation of one-man cars. Mr. C. D. Cass laid it down that in all cases it is necessary to provide a door-opening mechanism to be controlled by the driver, and a fare-collecting scheme also under the driver's control. Rear doors are locked in such a way that they cannot be opened from outside. In the author's opinion the one-man cars of the Illinois Traction Company (described above) are the best designed in the United States.

Mr. C. R. Beck, in the second paper, gave some experiences of working one-man cars on a route $3\frac{1}{3}$ miles long in Fort Worth, Texas. The service previously given was a 15-minute headway during the slack time and $7\frac{1}{2}$-minute during the rush hours. Double-truck cars seating 40 passengers each were used. The line is single track, with many points and curves and no level parts. The running time for the round trip of 6·6 miles was 45 minutes, giving 8·8 miles per hour. With the one-man cars, seating 28 passengers each, the respective headways were reduced to 10 minutes and 5 minutes. The time for the round trip was reduced to 40 minutes, or an average schedule speed of 9·9 miles per hour. The number of passengers within the first fortnight increased by nearly 17 per cent., but as the car mileage was increased 50 per cent., the receipts per car-mile went down. The old cars took 2·4 KW. hours of energy per car-mile, while the new ones only required 1 KW. hour. The figures include line losses. The total energy consumption per day fell off by 25 per cent. in spite of the increased car-mileage.

TRAMWAY SUBWAYS PROPOSED FOR BIRMINGHAM.

When the tramways of Birmingham were owned by a company the local authority refused to allow the lines to be laid in the central streets. The resulting inconvenience to the public has been very great, and has not been obviated by the enterprise of the Corporation in running motor omnibuses since the tramways came under their control, and in allowing omnibuses from outside districts to run to the centre of the city. In order to meet the convenience of the travelling public the Tramways Committee are about to consider a scheme, which is under preparation by Mr. Alfred Baker, the general manager, for the construction of subways. This would enable various routes to be extended into the heart of the city. The matter was mentioned by the Lord Mayor at a meeting of the local Rotary Club, on January 22, and on the following day the Tramways Committee definitely instructed the manager to prepare his scheme. We may add that when Mr. Baker was general manager of the London County Council Tramways he investigated subway construction in America, and presented a report upon which the engineers prepared the plans for the construction of the subway from Theobald's Road under Southampton Row, Kingsway, and Aldwych to the Victoria Embankment at Waterloo Bridge.

A TALK TO YOUNG ENGINEERS.*

By E. W. Rice, Jun.

(President of the American General Electric Company).

I am always glad of an opportunity to speak to engineers, and particularly to young engineers such as I see before me. I wish, first, to congratulate you upon your choice of a profession. I cannot imagine any more interesting work or any greater opportunity for valuable service than that of the engineer. The one man that I truly envy is the engineer, and you engineers who have had the advantages of a modern technical education are certainly most fortunate. Those of you who have made good use of your opportunities are starting your professional career with a theoretical training which was denied to those of us who started in the electrical industry in its early days. However, you will have good use for all your training and for all the wit and wisdom with which you are endowed in your future work, as our industry is no longer small and simple, but has grown to stupendous size and of corresponding complexity.

Of course, much of your work and many of your problems will be similar in character to those which have been in existence since the beginning of the industry, but you will have other and more difficult problems to solve, problems which were possibly largely created by the present and the early workers in your profession. The pioneers of our business were naturally fully occupied with the problems which belong to the beginning and development of any enterprise. The engineer spent his entire time in the solution of his engineering problems, just as the financier and the manufacturer were engrossed in their particular work. It has taken all the time, energy, and ability of these men to make discoveries and inventions, to build up the business, to organise it, and to administer it.

The work of the last generation of engineers, to which you are now succeeding, has on the whole been well done. I will not take the time to describe the results of this work as they are in evidence on every hand and are well known to you all. This wonderful industry had its commercial beginning less than a third of a century ago, since which time the electric light, the electric trolley car, the electric motor, the long-distance transmission of electrical energy, long-distance telephony, and a multitude of other useful electrical devices have been created and have become the common-places of daily life. It will be your duty, and also your great pleasure, I am sure, to carry on the work which has been already so well begun.

I wish, however, to point out that while your technical problems will be similar to those which engaged the

* At a recent meeting of the Schenectady Section of the American Institute of Electrical Engineers Mr. E. W. Rice, jun., addressed the members and delivered the able and suggestive address the substance of which we here reproduce, from the American *General Electric Review*. While Mr. Rice was specially dealing with social and political conditions and problems as they present themselves in the United States to-day, the student of contemporary movements in this country will be struck with the similarity of the position in both countries. Each has entered on uncharted economic seas, and the vigilance of every intelligent and right-thinking man will be needed to avert disaster, and to guide the ship of State through the dangerous channels into which this country will enter on the termination of hostilities. What Mr. Rice has to say with respect to education applies with even greater force to the condition in this country; for the provision for technical education has not as yet received as much attention here as in the United States. The address should receive the earnest consideration of a much larger class than those who may be designated as "young engineers," and we suspend our usual comments under the heading "Trade After the War" to enable us to place Mr. Rice's sound views before our readers.

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time and energies of your elders, you will have other and additional problems to solve of possibly greater importance, and it is to these problems that I wish briefly to direct your attention. These problems are, briefly, those of economics and those of politics. The engineer has always been knowingly or unknowingly interested in economics, but has usually let politics severely alone. The engineer of the future must, however, take an active interest in both subjects.

It is the engineer's business to produce wealth; he does this by making discoveries and inventions, by making better use of material and of labour, by saving by-products and preventing waste, by multiplying the effectiveness of labour as by the invention of labour-saving tools and devices, and in other ways too numerous to mention. The net result is, and must be, if he is successful, a constant increase in the amount of the material wealth which is the basis of our prosperity and even of our existence.

However, if you have read the newspapers, or have used your eyes, ears, and brains, you must have become painfully aware of the fact that there has grown up a large body of men whose business it seems to be to reduce the effectiveness of your work as much as possible. A large and apparently growing class of men seem to act upon the theory that efficient production is undesirable, that production should be limited to the minimum rather than increased to the maximum, and that the cost of production may be constantly and indefinitely increased without damage to industry or their own interests. The fallacy which underlies this theory and practice is, of course, evident to you educated men. It is the fallacy that there is only a limited amount of work to be done in the world and that the less work each man does individually the more work there will be left for the other fellow. These teachers of false economic doctrine and practice seem to assume that it is undesirable to increase the amount of goods produced in the world, that the fewer the goods produced the more there will be to divide. Now, in my judgment, it will be necessary for you to make a careful study of this situation and combat in every proper way this false and dangerous practice. Of course, you know that the more there is produced in the world the more there will be to divide, and while it may be true that as long as men live there will be a disagreement as to the division of the good things which are produced, it is simply suicide for any of us to adopt practices which restrict or reduce the amount of useful goods produced. You should try to ascertain the reason for the growth of this suicidal policy, and it will be your duty to help to find a solution of the problem, which is found in every civilised country. It is manifestly impossible for us to continue to make progress unless we all pull together. I do not wish to have you think that those who are now charged with the responsibility of manufacturing and engineering are indifferent to this situation; on the contrary, all progressive companies and individuals are seeking a solution, but we need your help to combat inefficient practices and false doctrines.

Until comparatively recent times we as a people have been satisfied to confine the activities of our legislatures to the rather well-known and generally accepted sphere of government. However, during the past decade or two there has been a demand for legislation of an entirely novel character; you are familiar with its nature. Statutes of all kinds for the regulation and restriction of business activities, laws of a paternalistic and socialistic nature, have been ground out at a constantly accelerating rate. We have departed a long way from the old-fashioned doctrine that "every man should be the architect of his own fortune and the pilot of his own pursuit of happiness." I do not wish to have you consider this statement as a criticism or as an approval of the existing tendencies. I wish, however, to make this appeal. You engineers have had a good, scientific education; this education should have given you a capacity to look facts in the face; it should have given you a constructive point of view; you should be largely free from prejudice; and, above all, your training should have made you intellectually honest. I do not think the country has anything to fear from the conclusions which you will reach, provided you take the time to study the problems that are presented and use the same methods in arriving at a conclusion that you would use in your daily engineering work.

If Government is to continue to regulate business, and, particularly, if it is to extend the field of its activities into business and institute competition with private individuals, it is essential that the men we elect to Government positions should be possessed of accurate knowledge of modern business, of which engineering constitutes a most important feature. Modern business is no longer simple; it is highly complex, and, to be successful, demands the highest technical experience, scientific skill, unflagging industry, intellectual honesty, great administrative ability, initiative, and resourcefulness to meet the ever-changing conditions. Our political bodies as at present constituted cannot possibly administer such a delicate and intricate situation with success. Disaster can only be averted by improvement in the quality and character of our legislatures and executive instruments. You technical men must take a hand in politics or politics will take you in hand, and you will soon have no business.

I think you will agree that ignorance, superstition, and prejudice are the most dangerous enemies of social happiness and industrial progress. Europe was plunged into intellectual darkness for a thousand years because of the ascendency of the forces of superstition and ignorance. I believe that future prosperity and happiness will be largely in proportion to the social diffusion of sound knowledge. Therefore, the greatest emphasis should be placed upon *education*, and I believe you all will agree that the best kind of education for every citizen is what is known as a scientific education. I do not mean a narrow technical education but a broad education which includes all useful experience and knowledge, but with special emphasis placed upon scientific principles. I think that there was no time in the history of the world when a scientific education was more useful or more necessary to a correct point of view or to make possible that adjustment to one's environment which is necessary not only to survive but to progress. Educated men, therefore, have a duty—a selfish duty if you please—to take a lively and constant interest in all matters of education.

It is also vital that we should take an interest in those whom we select to represent us in Government offices. We must not only have honest men, men possessed of so-called common honesty, but men possessed of that rare quality—intellectual honesty; men who scorn to be swayed from their duties by threats from any class of men; men who will not capitulate to capitalists or yield to unjust demands of so-called labour, or of farmer or of merchant, but who will have regard in all their actions for the interests of the people as a whole. It is a fatal fallacy to suppose that one group of citizens can be exploited at the expense of another group without all of us suffering in consequence. If production is restricted, if success is penalised, if weak and incompetent men are placed in position to control the competent and efficient, industrial disaster will follow as surely as night follows day.

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THE
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Regenerative Control.

Ever since the early days of electric traction it has been theoretically known that the motors which drive electric cars can be converted into generators, and thereby check the speed of the vehicles when descending gradients. By proper adjustments and connections the motors acting as generators may be made to return energy to the line. In this way braking down hill may be a saving instead of an expense. Years ago regenerative control was tried on several hilly tramway routes in this country, and though the system was favourably reported on at the time no developments ensued. As will be seen from papers read before American societies, which are abstracted in our present issue, renewed attention is being turned in the United States to regenerative braking. This arises from the method having been adopted recently on some electrified railways which have very severe gradients and where heavy trains are handled. Prominent among these is the mountain section of the Chicago, Milwaukee and St. Paul Railway, where it is said that the success of the method has exceeded all expectations. So much power is returned to the line in descending the gradients that the energy actually required to move the trains over the mountains is only 16 per cent. greater than that required on level track. The system is capable of application to three-phase and single-phase traction, but the mountain railway in question uses direct current like a tramway, except that the pressure is much higher. What can be done with success on a big scale should also be possible on a comparatively small scale. Especially if favourable reports from America continue to multiply, it will not be surprising to find that after the war British tramway authorities who possess hilly routes will turn their attention to the possibilities of regenerative control. Electric railways in this country as a rule have not severe gradients, but such a line as the Shildon and Newport mineral railway on the North Eastern system might profit regeneratively. The ruling gradients to Newport are down, and in this direction the trains are loaded. They might going down hill regenerate as much energy as would take others back part of the way in their empty condition. And, also after the war, we may see electric traction applied to other British railways where gradients have to be seriously reckoned with. Altogether, there are prospects.

Cost of Labour.

The cry comes from the United States that the cost of labour has become enormous. Even in that land of high wages, it is affirmed, labour has never been so expensive as it is now. This no doubt arises largely from circumstances growing out of the European war. America is flooded with European orders and European gold; the prosperity of the manufacturer is unprecedented; the workman takes his share in the shape of abnormal wages. It is true that the cost of living has also gone up, but that does not make the wage any smaller for the employer to pay. So many employers, especially those who do not share in the manufacturing prosperity incident to the war, are trying even more than usual to devise labour-saving machinery and appliances. We may take a lesson in this country for application specially after the war. At present wages and cost of living have gone up enormously, and so have the profits of those employers who are engaged on war contracts. But labour is not only dear but excessively scarce. For that reason, and because it is not

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a time for incurring fresh capital expenditure, employers cannot contemplate at present the instalment in workshops—including, of course, tramway workshops—any new devices, even though known and desired, which would cost much money or labour to provide. But after the war some things will be different. The ban on fresh capital expenditure will be removed. Men from the army and the munition shops will crowd industry. On the other hand, the work of making up industrial and manufacturing arrears is likely to be so large that wages will probably remain high. Certainly the cost of living will not fall materially in a day or a year. Hence employers will do well to keep track of developments in labour-saving devices with the object of adopting them as required. Such devices may at the moment throw some men out of employment, but work on the whole promises to be abundant. Moreover, history shows that labour-saving appliances and machinery so increase the demand for the articles produced that more men are employed instead of fewer. And all the time the turnover and the profits and the wages in the aggregate increase.

Engineers and Economics

That an engineer's training is of enormous value to any man who wishes to succeed in industrial administrative work, and in the organisation and the management of employees, few will deny. The lawyer develops into the politician because they are both men of words, of argument, of negotiation; the engineer develops into the administrator and the business man because they are alike men of action and deeds, men of clear insight and practical common sense, who do things and get things done. Midway, it may be said, between the widely separated and often mutually exclusive realms of politics and engineering comes economics, and this is a region in which the engineering frame of mind might with advantage have more play. Attention is drawn to this point in an excellent lecture to young engineers by Mr. E. W. Rice, which we include in this issue. An entirely sufficient reason why engineers should take an interest in economics is the fact that it is the engineer's business, among other things, to produce wealth. The point to which Mr. Rice directed attention is the fact that there is a large class of men who wish to limit production because they absurdly profess that there is not enough work to go round if all men work at full efficiency. The lecturer conceives it to be the duty of the engineer to help to find a solution for the problem. He certainly is in a good position to do so, because of his manufacturing and workshop knowledge and his acquaintance with the methods of "ca' canny" trade unionists. We in this country have suffered far more than America has done from artificial restriction of output by workmen. That policy has for the time being been swept away by the war, but the trade unionists have been promised by the politicians a complete restoration of the old restrictions after peace is restored. That promise clearly cannot be fulfilled, but some basis of arrangement must be found under which the necessary new conditions may be introduced without injustice to the workers and with their consent. A large section of the working classes, taught by experience since the war began, already admit the error of the old way. Employers in many cases must share the blame for the old system, and it would seem that engineers, with their practical knowledge and the special type of mind given to them by their training, might be of great assistance in bringing about a practical solution which would develop our industries and give good wages and work for all. Apart from this particular instance, it is manifest that as Governments interfere more and more with trade and industry, and even carry on business, they involve themselves more in economic questions with which they are too often quite unfitted to deal. For this reason also engineers must for economic reasons concern themselves more with politics and see to it that men properly educated and trained in practical affairs are appointed to deal with matters which directly concern the wealth and prosperity of the country. Of these matters none is more important than that of education; and here the influence of the engineer is pre-eminently needed.

Tramways and Town Planning.

The chairman of the Birmingham Tramways Committee has done good service to local authorities by the paper he recently presented to the Town Planning Institute on "Housing and Town Planning After the War." Extracts from the paper were

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given in our issue of January 11, and we hope that Councillor Harrison Barrow's conclusions will lead members of tramway committees to urge their local authorities to devote more attention to the planning of undeveloped building sites in and around their boundaries. Up to the present time comparatively few municipalities have taken advantage of the Town Planning Act, notwithstanding that the need for housing accommodation is a pressing problem. Its gravity has been exemplified in numerous centres by the influx of thousands of munition workers, while in the case of national factories erected in the open country or near water communication the Government have had to build large towns for the accommodation of the employees. Future needs in this direction are likely to be very great in consequence of the decision to erect additional munition factories, which explains the call recently made upon building trades for the services of fifty thousand workmen. The housing question will evidently place great difficulties in the way of Mr. Neville Chamberlain's task of organising the nation for war work. All of this gives point to Mr. Barrow's assertion that hitherto local authorities have dealt in a niggardly manner with the housing problem. If they are wise enough to profit from the lesson that has been forced upon them, especially during the past year, neighbouring towns will combine to act upon the advice of Mr. Barrow that no time should be lost in taking the comparatively inexpensive steps of planning their unbuilt areas into three zones. Concurrently with this work Mr. Barrow advocates laying out arterial roads with special provision for tramways on sleeper construction. In this way an opportunity would be obtained for the use of the economical method of electric traction for the transport of goods and agricultural produce. The comparatively light expense of sleeper construction on a special track would conduce to the realisation of these suggestions, thus fulfilling Mr. Barrow's scheme for the linking up of urban districts and the forming of a joint committee for the management of the undertaking. The growth of heavy motor traffic generally would no doubt have to be taken into consideration, and if provision were made for this the authorities would have a claim upon millions of pounds that the Road Board have accumulated. The work would also be of value as a means of assisting in the reorganisation of industry at the close of the war.

LONDON RAILWAY FARES.

Since the beginning of this year the local railway fares of the Metropolis have been in a state of chaos, and public discontent has run high. All the trouble arose from the application to London of the Board of Trade order which came into force on January 1 that passenger fares on practically all the railways of the country should be increased by 50 per cent. Into the question as regards main line travelling we do not propose to enter; there seem to have been good and sufficient reasons for the change. Unnecessary travelling had to be reduced in order to facilitate war traffic. Insufficient consideration, however, was given to the exceptional conditions of London. It is not too much to say that the railways in and immediately around the Metropolis carry one thousand million local passengers per annum. A very large proportion of these are necessary journeys; the pleasure element is very subsidiary. The fact that there is no increase in season ticket rates nor in workmen's fares is only a palliative.

From the first it was apparent that there would be no increase in "tube" railway fares, as these lines are not under Government control. But the Metropolitan and the Metropolitan District Railways are, and it was plain that the system of through bookings between these lines and the "tubes" would be prejudiced if not destroyed should the former have to raise their fares. So from the first it was decreed that within a large central zone there should be no increase on the two railways mentioned. The increase was, however, applied on the main line railways right into the centre of London. Hence arose another trouble.

While District and Metropolitan fares within the zone remained as before, for all journeys partly within and partly outside the zone the increased fare was charged for the whole distance. For example, from the Mansion House to Putney Bridge the old fare was charged, but to Wimbledon, a little further on, the new fare had to be paid for the whole distance. This, of course, could be evaded by re-booking at Putney, but that meant delay. An irritated public could not understand this apparently arbitrary arrangement. But the reason was quite good. To such places as Wimbledon and Ealing there is competition with main line railways, and the latter have to charge the increased fare all the way.

Such a condition of affairs is absurd and inequitable. The order was made before Sir Albert Stanley became President of the Board of Trade, and the then President was no doubt advised by the Railway Executive Committee, the members of whom, though railway experts as regards the country generally, have no special knowledge of the peculiar conditions of local passenger traffic in London. Sir Albert Stanley, however, from his experience on the Underground Railways, has a special knowledge of the matter, and it may be hoped that he will find some better arrangement. The obvious thing to do, if it is practicable, is to restore the old fares on all railways in the metropolitan area, making that zone wide enough to embrace the outlying suburbs. It is absurd to suppose that local traffic can be diminished without grave injury to business. Moreover, even if such traffic were entirely suspended, no rolling stock would be released from the electric railways for other services. That rolling stock is wholly unsuitable for steam railways.

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REGENERATIVE BRAKING.

The application in the United States of electric traction to railways having steep gradients has led to an extension of the use of regenerative braking or control. Years ago it was tried on some tramways in this country, but for one reason or another was abandoned. That in certain circumstances the system is of great advantage is undeniable, and it seems to be proving its worth on the long and heavy gradients of the mountain section of the Chicago, Minneapolis and St. Paul Railway, the electrification work on which was recently described in our pages. A very useful paper entitled "Regenerative Braking of Electric Vehicles," by Mr. R. E. Hellmund, was presented at a meeting of the American Institute of Electrical Engineers at Pittsburgh on January 12. This paper describes various systems of regenerative braking, and special attention is paid to those systems which are well adapted to illustrate some fundamental principle and to those which are of practical importance. The three-phase system and the phase converter system are discussed, and then direct-current systems of regenerative control are exhaustively dealt with. Alternating current commutator motor systems are also described.

The author's preliminary statement is of general interest. The fact that a motor driving an electric vehicle may be converted into a generator, and that it will as such exert a braking effect, was known very soon after the electric propulsion of vehicles was introduced. It is when the electric energy generated while braking is returned to the power supply system that the arrangement is called regenerative braking. The following summarises the advantages cited by the author, as compared with purely mechanical braking :—

1. Reduced wear of mechanical braking devices, resulting in reduced maintenance cost for wheels and brake shoes.
2. Greater ease and safety in handling the vehicle, with reduced maintenance of couplings and other parts.
3. Higher permissible average speed in descending gradients.
4. Increased safety by elimination or reduction of tire heating resulting in loose tires.
5. Power economy, which amounts in many cases to a saving of 15 per cent. or more.

The requirements necessary to accomplish those results include increased current capacity of the main motors, involving increased dimensions or increased ventilation ; additional equipment on the vehicle for controlling and safeguarding the regenerative operation ; additional equipment in the generating or transforming stations ; adjustment of the system against increased tendency to voltage variation. The disadvantages are :—

1. Increased weight of vehicle equipment.
2. Increased first cost of vehicle equipment.
3. Increased cost of maintenance of vehicle equipment.
4. Increased complication and consequent reduced reliability of operation.
5. Increased complication and consequent reduced reliability of the power-house, sub-stations, and line protecting apparatus.
6. Increased first cost of copper in the transmission system.

The importance of the advantages and disadvantages depends to a large extent on the individual system applied and on service conditions. Most of the disadvantages, however, are not of very great practical importance in most cases where conditions are such that the saving in power consumption is appreciable, say 10 per cent. or more, or where an equivalent saving is brought about in the maintenance of brake shoes and wheels by increasing operating speed or the like.

After his detailed discussion of the various systems of regenerative control, Mr. Hellmund concludes :— In view of the numerous possibilities for successful regeneration, it is to be expected that regenerative braking will soon assume great commercial importance. It should therefore be exhaustively considered in any new electrification, and the time is approaching when its possible application should be investigated for the larger existing non-regenerative installations. In view of the practical advantages of regeneration for heavy railroad work, it is even quite likely that regeneration will in time become one of the factors which will win some railroads, now operated by steam, over to the electric cause.

Experience on the Milwaukee.

Mr. G. H. Hill, assistant chief engineer of the General Electric Company (U.S.A.), in a paper read in November before the New England Railroad Club, referred to regenerative braking on the electrified section of the Chicago, Milwaukee and St. Paul Railway. He said that the success of the method has far exceeded all expectations. The braking effort is so completely under the control of the engineers that they much prefer it to the air brake. They find that regenerative braking means less danger of drawbar failures, and much less care is required to avoid dangerous surges in the trains.

The electric locomotives were designed to haul 2,500 tons up a 2 per cent. grade at 15 miles per hour. They have been used successfully to haul 3,500 tons on the 2 per cent. grade, and it has been found necessary to increase the length of the passing sidings in order to utilise the maximum hauling capacity of the locomotives. Before the electrification it was usual to have the freight cars congested at the entrance of the mountain division, and it occasioned some surprise to find that the electric locomotives not only could easily keep this congestion from forming, but delivered the tonnage to the neighbouring divisions of the railway faster than it could be hauled away.

The time occupied on the mountain division has been much reduced. Both the passenger and the freight schedules have now been reduced by about 30 per cent., and the schedule is maintained with greater reliability. Freight trains that formerly required ten or twelve hours to make the run of 115 miles from Three Forks to Deer Lodge now require seven or eight hours. The mountain division is now counted upon to make up time lost by steam passenger trains on adjacent divisions.

Tests between Colorado Junction and Three Forks show that the total power taken to cross this division (including the 2 per cent. grade) corresponds to 31·7 watt-hours per ton-mile neglecting the power returned by electric braking. The actual net power required, taking account of the regenerated power, is 23·7 watt-hours per ton-mile. From these figures it may be calculated that to move the train over the same distance on level track of the same curvature would be 20·4 watt-hours per ton-mile. It appears, then, that the energy actually required to move the trains over the mountains is only 16 per cent. greater than for a level track, and that the energy required to move the train without any return from braking is 55 per cent. more than that actually taken. In other words, electric propulsion by regenerative braking has eliminated 70 per cent. of the mountain from the point of view of actual power required.

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THE "SAFETY FIRST" MOVEMENT.

First Meeting of the London Council.

At the first meeting of the London Safety First Council, which was held on January 15, at Caxton Hall, the Mayor of Hampstead presided over an attendance of 75 representatives of local authorities and other bodies interested in traffic matters. Among the 34 borough and urban councils' delegates were the following, who included chairmen of tramways committees and the general managers of their undertakings :—

Bexley Heath.—Councillor E. J. Reid and Mr. H. P. Stokes, general manager and electrical engineer.

Croydon.—Alderman G. J. Allen, chairman Tramways Committee and the town clerk. Mr. T. B. Goodyer, the general manager, was present as honorary secretary of the Metropolitan Association of Electric Tramways Managers.

East Ham.—Councillor Taylor and Mr. Wm. C. Ullman, general manager and electrical engineer.

Walthamstow.—Councillor C. Watkins, Mr. E. Morley, surveyor, and Mr. W. Murray, tramways manager.

West Ham.—Alderman White, Councillor Kensett, chairman Tramways and Electricity Committee, and Mr. M. L. Slattery, general manager.

Other tramways organisations were represented as subjoined :—

Tramways and Light Railways Association.—Mr. R. J. Howley, member of the council.

Metropolitan Association of Tramways Managers.—Mr T. B. Goodyer, honorary secretary.

London United Tramways Company.—Mr. A. L. Barber, secretary.

Metropolitan Electric Tramways Company.—Mr. A. H. Pott, general manager and engineer.

South Metropolitan Tramways and Lighting Company.—Mr. A. V. Mason, general manager and engineer.

Motor omnibus undertakings sent the following :—

Associated Omnibus Company.—Mr. P. W. Tibbs, managing director and secretary.

London General Omnibus Company.—Mr. J. P. Thomas, general superintendent.

National Steam Car Company.—Mr. T. Clarkson, managing director.

Thomas Tilling, Limited.—Mr. W. Wolsey, jun., managing director.

Tramways (Metropolitan) Omnibus Company.—Mr. J. Devonshire, chairman.

From railways and various associations the following attended :—

Great Western.—Mr. E. S. Hadley, general manager's office.

London and North-Western.—Mr. R. H. Paterson, London cartage assistant.

London and South-Western.—Mr. F. V. Milton, publicity department.

London, Brighton, and South Coast.—Mr. G. H. Dennis, publicity department.

Metropolitan.—Mr. W. Holt, traffic superintendent.

Underground.—Mr. H. E. Blain, operating manager.

Automobile Association.—Mr. W. Joynson-Hicks, M.P., chairman.

Boy Scouts.—Mr. A. G. Barralet.

Commercial Motor Users' Association.—Mr. F. G. Bristow, secretary.

Cyclists' Touring Club.—Mr. W. Burke.

Institution of Municipal and County Engineers.—Mr. T. W. A. Hayward, vice-president.

Illuminating Engineering Society.—Mr. L. Gaster.

Royal Automobile Club.—Mr. W. Worby Beaumont.

Roads Improvement Association.—Mr. H. P. Boulnois, vice-chairman.

Delegates were also present from tramway and vehicle workers' unions, motor cab companies, South Metropolitan Gas Company, Selfridge and Company, etc., and from the Metropolitan and City of London Police, the former force being represented by Superintendent Bassom, of the public carriage department. Mr. R. C. Maxwell, an inspector of the Local Government Board, will be in attendance at meetings of the council.

The following officers were elected :—President, the Right Hon. Lord Sydenham of Combe ; vice-president, Sir George Gibb, chairman of the Road Board ; chairman of council, Mr. J. W. Joynson-Hicks, M.P. (who thereupon took the chair) ; vice-chairmen, Sir Ed. Smith, L.C.C., and the Mayor of Hampstead (Alderman O'Bryen) ; hon. treasurer, the Mayor of Westminster (Sir Geo. E. Welby) ; hon. secretaries, Messrs. H. E. Blain, A. P. Johnson, and Albert E. Cave, communications for whom should be addressed, care of London "Safety First" Council, 45, Westminster, Broadway, S.W.

The following committees were appointed, the officers being *ex-officio* on each :—

Street Dangers Committee.

Alderman J. J. Bisgood, J.P., Richmond ; Councillor H. Newton Knights, J.P., Camberwell ; Alderman A. E. Hughes, Marylebone ; Councillor Kensett, West Ham.

The following borough surveyors :—Messrs. J. W. Dugdale-Bradley, Westminster ; A. Scorgie, Hackney ; E. Morley, Walthamstow ; P. Dodd, Wandsworth ; E. Willis, Chiswick ; and Messrs. H. Percy Boulnois, Roads Improvement Association ; W. Worby Beaumont, Royal Automobile Club ; L. Caster, the Illuminating Engineering Society ; H. B. Stokes, South Metropolitan Gas Company ; F. W. C. Ashwood, British Motor Cab Company ; A. H. Pott, Metropolitan Electric Tramways ; W. Wolsey, jun., Thos. Tilling, Limited ; R. H. Paterson, London and North-Western Railway ; S. March, National Union of Vehicle Workers ; Superintendent Bassom, representative of the Commissioner of Police ; Inspector James, representative of the Commissioner of Police for the City of London.

Publicity Committee.

The Mayor of Lewisham (Alderman A. Hume Nicholl) ; Councillors G. W. Brading, Deptford ; E. T. Butteriss, Willesden ; Duff, Wimbledon ; Newton Knights, J.P., Camberwell ; S. Powell, J.P., Chiswick ; C. Watkins, Walthamstow ; Messrs. A. G. Barralet, Boy Scouts' Association ; A. E. Cowper, Selfridge's ; G. H. Dennis, London, Brighton, and South Coast Railway ; F. W. Goodenough, the British Commercial Gas Company ; T. W. A. Hayward, M.I.C.E., the Institution of Municipal and County Engineers ; E. S. Hadley, Great Western Railway ; F. Y. Milton, London and South-Western Railway ; N. Scorgie ; E. S. Shrapnell-Smith, Commercial Motor.

Drivers' Educational Committee.

Councillor F. G. Pickering, Finsbury ; Messrs. F. W. C. Ashwood, the British Motor Cab Company ; F. G. Bristow, secretary, the Commercial Motor Users' Association ; T. Clarkson, the National Steam Car Company, Limited ; G. A. Dutfield, London Cartage Contractors' Association ; J. Devonshire, Metropolitan Omnibus Company ; T. B. Goodyer, Metropolitan Association of Electric Tramways Managers ; R. J. Howley, the Tramways and Light Railways Association ; A. V. Mason, South Metropolitan Tramways ; W. Murray, Walthamstow Tramways ; J. Mears and S. March, National Union of Vehicle Workers ; M. L. Slattery, West Ham Tramways ; B. Smith, the London and Provincial Union of Licensed Vehicle Workers ; J. P. Thomas, L.G.O.C. ; W. C. Ullmann, East Ham Tramways ; C. Watson, Amalgamated Association of Tramway and Vehicle Workers ; W. Wolsey, jun., Thomas Tilling, Limited ; and E. W. Rudd.

A Finance Committee was appointed, to consist of three representatives of each of the foregoing committees, with the officers. The questions of organisation and subscriptions were referred to the General Purposes Committee for consideration and report.

The Street Dangers Committee were asked to report upon the following suggestions that were advanced at the meeting :—

Colour scheme for the lighting of street lamps, indicating the off and near side.

A colour scheme for the lighting of street refuges and street obstructions.

Consideration of the rule of the footpath for pedestrians.

The production of a more effective luminous paint, and a more effective whitening mixture for kerbs, etc.

Safety white armlets for pedestrians.

Way-pointing indicators for cyclists, etc.

To the General Purposes Committee the following proposals were referred :—

The formation of a "Safety First" League for motor-users, boy scouts, etc.

(*Continued on page 94.*)

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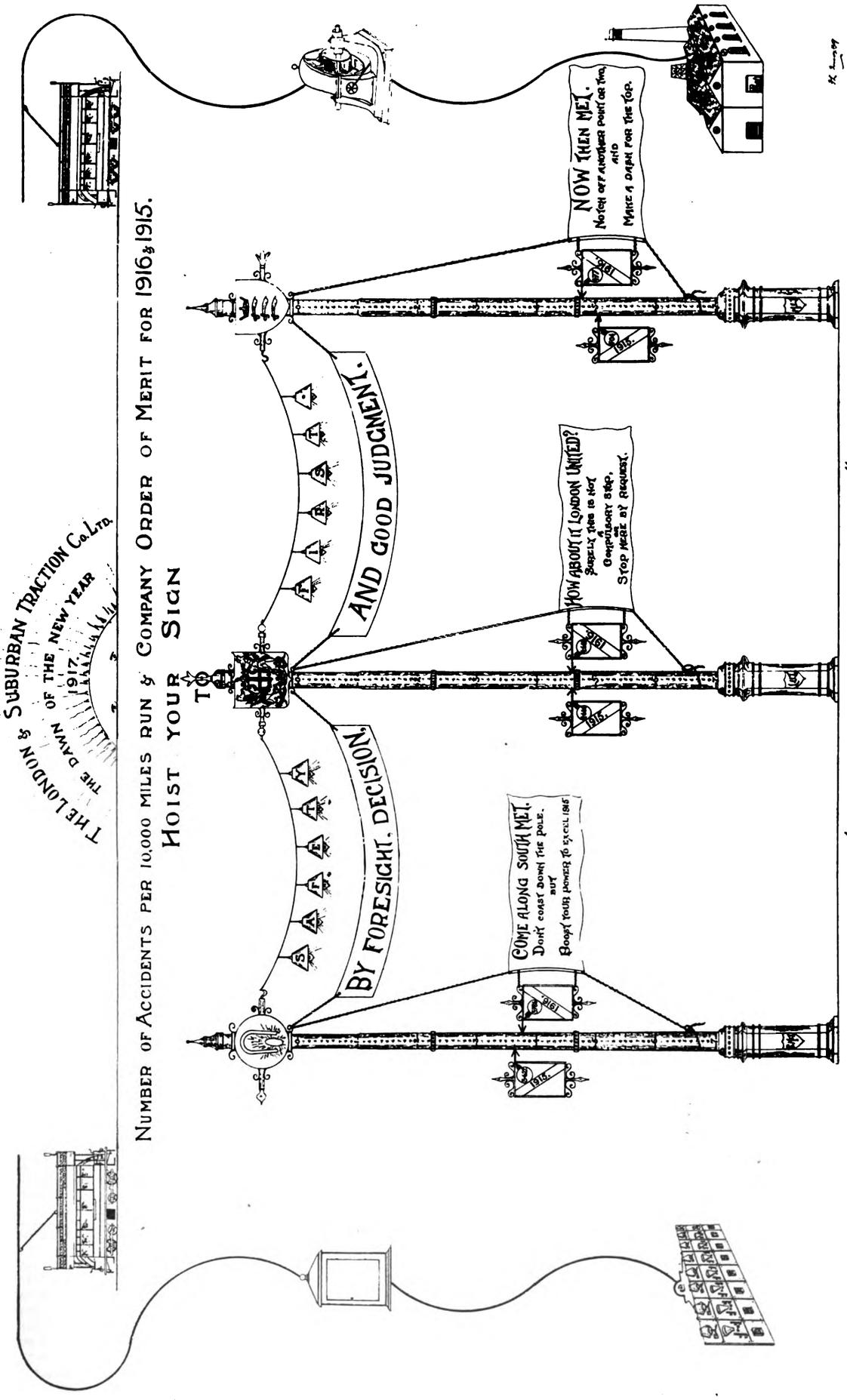

Promotion of Safety First on London Company Tramways

A Cartoon issued by the London and Suburban Traction Co., Ltd.

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The issue of a "Safety First" button.

The extension of the "Safety First" movement in connection with fire, health, etc.

The same committee were requested to consider the question of approaching the few local authorities who have not become associated with the movement.

Several delegates expressed the opinion that the lighting restrictions could be relaxed with safety, and the Street Dangers Committee were asked to consider the question as early as possible. The council's view of the matter was supported by a letter received from Lord Sydenham, who was for several months a member of the Air Board.

SHEFFIELD.

Mr. A. R. Fearnley, general manager Sheffield Corporation Tramways and Motor Department, has issued the following notice :—

SAFETY FIRST.

TO DRIVERS OF ALL CLASSES OF VEHICLES.

In the interests of all road users your assistance is requested in the PREVENTION OF ACCIDENTS by the OBSERVANCE of the following ROAD RULES AND SIGNALS :—

1.—DON'T PULL OUT FROM THE KERB-SIDE without first looking round and signalling approaching traffic.

2.—DON'T ATTEMPT TO CROSS A MAIN THOROUGHFARE from a side street without first ascertaining that you can safely do so.

3.—REMEMBER WHEN CROSSING A STREET with a vehicle in the dark that front and rear lights cannot be seen by approaching traffic.

4.—DON'T BACK VEHICLES out of side streets or passages without someone to warn approaching traffic.

5.—PLEASE KEEP OFF THE TRAMWAY TRACKS AS MUCH AS POSSIBLE AFTER DARK.

The advertisement led to a brief discussion at the City Council's meeting on January 10, when Alderman W. C. Fenton, vice-chairman of the Tramways Committee, replied that similar steps in advertising had been taken by the London General Omnibus Company, with good results, and the committee hoped to have similar results. The motormen were driving in very difficult times, and the strain was very severe in the darkened streets. The small number of accidents was very satisfactory as far as the conduct of the motormen was concerned. The accidents would be fewer if people driving motor lorries and cars would be more careful in backing or coming out of side streets.

MANCHESTER.

Manchester Tramways Committee have taken up the "Safety First" movement. Mr. J. M. McElroy, the tramways manager, has issued posters in red and blue, setting forth three "dont's" for tramway passengers and another for boys and girls. The latter reads, "Don't, on leaving school, race across the road." It is pointed out to the public that it is better to lose a few minutes than one's life; that one should look both ways before crossing the street, and that in all cases one should put the mental query, "Is it safe?" Mr. McElroy states that the campaign is prompted largely by the increasing number of accidents in the darkened streets, but that it is thought the public generally, and especially juveniles, might avoid day-time risks if the dangers are impressed on them. The nerves of car-drivers are sufficiently strained by keeping a keen look-out after dark without having their responsibilities needlessly added to in daylight by a careless public.

GLASGOW.

A year before the war Mr. J. Dalrymple, general manager Glasgow Corporation Tramways, vigorously took up the "Safety First" movement, which also figures in his message to the tramways employees for 1917. It is headed "Safety First, Safety Always," and in the course thereof Mr. Dalrymple says :—

"I should like to impress on both drivers and conductors the absolute necessity of taking greater care. Do not, under any circumstances, run your car ahead of time. Do not run your car past stopping-places when people are standing there. Do not start your car until you are absolutely certain that no one is entering or leaving. Do not ring the bell until everyone is on or everyone is off.

"So far as accidents are concerned, there are many circumstances conspiring against us at the present time. There is, of course, the inexperience of many of the staff. There is the overcrowding of cars. There is the Darkening Order. There is the 'drunk.' There is the boy in charge of the horse and cart. There is the general carelessness in the street, both on the part of pedestrians and of those in charge of vehicles. We have got to face all these difficulties and do our best to overcome them. And notwithstanding all these difficulties, I am quite sure that you are able to keep the service up to pre-war standard if you make up your mind to do so.

"To the conductresses I would say: 'Do not imagine that you know all your duties after being a week on the cars. Do not carry out your work as if you meant to leave the job to-morrow.'

"To the motoresses I would simply say: 'Gang warily. Take plenty of time. Do not put on a notch of power until you know that the road is clear.'"

SUMMER TIME ACT, 1916.

The Home Secretary has appointed a committee to inquire into the social and economic results of the Summer Time Act, and to consider (1) whether it is advisable that summer time (which was discontinued on October 2) should be reintroduced in 1917 and in subsequent years, and, if so, (2) whether any modification of the arrangements are required, and between what dates summer time should be made operative. The members of the committee are the Right Hon. J. W. Wilson, M.P. (chairman), Mr. Malcolm Delivinge, C.B., Mr. Charles Duncan, M.P., the Right Hon. Laurence Hardy, M.P. (representing the Board of Agriculture), Sir John Lonsdale, M.P., Miss T. M. Morton, Sir Walter Nugent, M.P., Sir Andrew Pettigrew, and Mrs. Herbert Samuel.

The General Purposes Committee of the London County Council have advised the Council to express their view in favour of the continuation of the Summer Time Act, 1916, in subsequent years. The committee have obtained the opinion of the committees concerned as to the operation of the Act during the past summer, and find that these committees are nearly unanimous in favour of the continuation of the Act. The general effect of the Act has been beneficial on the health of the people, but as regards young children in very poor neighbourhoods loss of sleep would appear to have increased slightly. It is understood that the Summer Time Committee appointed by the Home Office to investigate the result of the Summer Time Act and to advise as to the reintroduction of the Act in 1917 do not desire to receive further evidence in support of the views which have already been furnished to that committee.

GERMAN VIEW OF SUMMER TIME.

The Committee of the Prussian Diet recently brought forward a proposal to introduce summer time again this year and to extend the period from March to October. The Reporter recalled the objections to summer time raised by agriculturists, and considered it desirable to leave the decision in the matter to the Imperial Government. Representatives of the Prussian Government declared that most of the reports from the authorities and the working classes were in favour of summer time. A majority of the committee decided to proceed to the Order of the Day, as summer time, in their opinion, had been a failure. Subsequently the assembly voted again to adopt summer time.

Railway Companies' Reports.—With a view to economy and in order to assist the Post Office authorities, certain railway companies have decided to discontinue during the period of the war the practice of sending out a copy of their annual statement of accounts to every shareholder or debenture holder. A copy of the account will be sent to any shareholder or debenture holder of the company who applies for it, and announcements of the annual meetings of the various companies will be published in the newspapers.

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TRADE AS A SCIENCE.*

There is not much in this book so far as the number of words composing it are concerned, but in quality, in the value of the scheme it puts forward, in its suggestiveness of further developments of this scheme, and in its conciseness and clearness it is worth many volumes. In his preface to the book Lord Burnham truly says: - "Like all stimulative books, it is also provocative in places; but that the author is on the right lines, and that every trader, whether great or small, would do well to study the following pages, few who read will doubt."

The book is businesslike and practical to a degree, and while it contains destructive criticism of British trade arrangements—or rather want of arrangements—its great feature is that it puts forward a comprehensive constructive scheme for organising and developing the trade of this country, so that after the war we shall be able not merely to hold our own against foreign competition, but to expand our commerce enormously. In briefest form, this scheme of development is based on a Ministry of Commerce, with an associated trade association for every important trade in the country. It should be explained that the word trade is used by the author to mean the production and selling of goods, and does not embrace much that would be included under the term commerce. Moreover, Mr. Benn professedly avoids any discussion of the question of tariffs. He thinks that great improvements can be brought about without tariffs, fundamental improvements indeed, and he leaves tariffs for future discussion after the fundamental improvements from organisation begin to show their effects.

The latest dates quoted by the author indicate that the book was written about the middle of the past year. If he were writing it now, he would doubtless have something to say about the recent revolutionary changes in the British Government, and particularly about the formation of a Ministry of Labour which to a certain extent clashes with the machinery which he advocates. The same remark applies to the recent constitution by the Government of a department of scientific and industrial research. However, if his plan were adopted, these departments could be merged in it.

Perhaps the nearest approach which has been made in the way of proposals to Mr. Benn's scheme is that which was published on December 11 last by a Glasgow committee representative of the Scottish iron, steel, shipbuilding, and engineering industries. That committee reported in favour of the formation of a Ministry of Industry and a National Advisory Council. The Federation of British Industries, on the other hand, on December 15 issued a report recommending that all the activities undertaken by the Government in connection with the promotion of British trade in foreign countries should be concentrated in the Foreign Office.

Mr. Benn's cry throughout is for organisation, and his own plan appears to be more thoroughly organised than many others which have been put forward. He proposes a Ministry of Commerce and a system of official trade associations. The co-ordinating point is that these associations, one for each important trade, should be controlled by the Minister of Commerce. A complete scheme is given for the working of such a Ministry and for a model association, and the exact duties which the officers appointed would perform are described. The complete constitution of a trade association is given, with exact particulars of committees and a full programme of work for each. Thus, though the scheme may be open to amendment, it is definite and precise, affording a basis upon which to work. The more one examines the details in the book as to the working out of the matter, the more one is impressed with the wide range of applicability of the scheme. It seems to be fitted to cope with widely varying conditions, and at the same time the whole enterprise would be a homogeneous whole under the supreme general control of the Minister of Commerce. There are no gaps, there is no overlapping, so far at least as the theory is concerned. In practice defects could be speedily remedied.

We may pass over the first part of the book, which deals with the defects of British trade methods, the want of organisation, the secrecy in regard to things a knowledge of which would be of benefit to the trade, the ineffectiveness of most existing trade associations, and the fact that chambers of commerce -highly useful in their own way—are no substitute for trade associations. Wasteful competition and the export muddle are also dealt with in this first section. In coming to the kernel of the matter it is pointed out that much of the success of the export trade of Germany and some other countries is due to the work of trade associations, but the present proposals do not profess to follow them as a model.

The personnel which Mr. Benn proposes for a Ministry of Commerce is as follows:—Secretary of State for Commerce; Advisory Council, consisting of the chairman of each approved trade association; Parliamentary secretary; permanent secretary; six under-secretaries, having charge respectively of export, industrial and scientific research, commercial education, statistics of finance, labour, and exhibitions and advertising; and 300 trade secretaries, half their salaries being paid by the Government and half by the associations. The number of 300 is based on the assumption that 50 trades would avail themselves of the scheme, and would each require six secretaries to deal with the six departments mentioned above. The duties of all these officials are carefully and systematically sketched out. The leading factor in the promotion of British industry should be the trade association, with just sufficient official acknowledgment to ensure that every trade is tuned up to the full height of its possibilities. Among conditions of official recognition are that the association should represent at least 60 per cent. of its trade in capital, output, and workers employed, that it should be a non-trading association so far as the home market is concerned, and that it should make no endeavour to regulate selling prices within that market. Then comes a suggested constitution for a model trade association, including a chairman, a national council, district committees, working committees, and a salaried staff. The work and duties of all these are outlined, and the scheme appears to cover most if not all the proposals put forward by various bodies in the past. At the same time it makes one co-ordinated whole. The six working committees with their respective secretaries among them range over the whole field of trade promotion under the six headings.

The remaining chapters of the book each take a subject of vital importance to trade, and show how the scheme would work in connection with these matters. With a wide knowledge of trade conditions and requirements, Mr. Benn points out in detail how the organisation he proposes would deal with concrete cases both at home and abroad. The further point may be made that in Mr. Benn's view it is not associations or federations of industries that are wanted so much as one strong association for each trade, working along with the central Ministry of Commerce. Whatever may be the expert criticism of the author's scheme, there is no doubt that its publication ought materially to advance the great movement for promoting British trade after the war.

(*) "Trade as a Science," by Ernest J. P. Benn, with introductory preface by Lord Burnham. London: Jarrold & Sons, 184 pp., 2s. 6d. net.

MONTREAL TRAMWAYS FRANCHISE.

The *Electrical News* (Toronto) of January 1 says:—Complying with the requests of several deputations, the Quebec Government have appointed a Commission, consisting of Senators J. P. B. Casgrain and Charles Beaubien, Mr. A. Verville, M.P., Mr. Charles Laurenieau (chief city attorney of Montreal), and Mr. P. J. Cockburn, of the Bank of Montreal, to settle a new franchise for the Montreal Tramways Company. The Montreal Controllers and the company have been conferring for several weeks on the subject, but progress was very slow, and an agreement seemed to be improbable. It was alleged that rival financial interests made a settlement impossible. The Commission have power to prepare a contract between the parties, after making inquiries, the total cost being borne equally by the city and the company. The new franchise is to be for 36 years, that is, 30 years beyond the present franchise. At the expiration of this period, and also at the expiration of five years subsequent, the city will have the right to acquire the tramways undertaking by paying the value as fixed by arbitrators and 10 per cent. additional for goodwill. One point in the agreement made by the Government to which objection is taken is that while the city is bound to accept the findings of the Commission, the company are free to refuse them, as the new franchise will not come into operation until the contract is signed by a majority of the Commission and the president and secretary of the company.

TO LESSEN TRAFFIC PRESSURE.

Placards were posted in Glasgow cars on January 20, appealing to ladies who may be shopping in the afternoon to make the return journey before 4 p.m., in order to lighten the pressure on the services.

Mr. J. M. McElroy, general manager, Manchester Corporation Tramways, has issued a poster which should be useful in reminding passengers of the difficulties that confront tramway operators at the present time. The poster reads as follows:—"Owing to shortage of labour, we have great difficulty in meeting the traffic demands at the 'rush' hours, viz., in to town from 8 to 9 o'clock in the mornings, and out of town from 5 to 7 o'clock in the evenings. The withdrawal of certain train services and the raising of railway fares have a tendency to increase our difficulties. We therefore ask all those who possibly can to avoid travelling at the 'rush' hours, and to use the car services at the slack times. And we specially ask those who come into the city in the afternoons for shopping purposes to proceed homewards not later than 4.30 p.m."

At a meeting of Manchester Education Committee, Alderman J. Bowes, chairman of the Tramways Committee, supported a suggestion by the tramways manager that the schools should be opened at 9.30 instead of 9 a.m. in order to relieve the pressure of passengers on the tramway service. The Education Committee decided that the proposal could not be acceded to, and the chairman observed that very few elementary school children used the cars.

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MUTUAL TRAFFIC AIDS.

EXPERIENCE IN AND AROUND CROYDON.

The general manager of the South Metropolitan Electric Tramways and Lighting Company, Limited, in July, 1915, submitted to the summer meeting of the Tramways and Light Railways Association one of the most interesting papers that has engaged the attention of the members. It was entitled "Glimpses Into the Obvious" (notes on tramway management). Mr. A. V. Mason is not content with placing his ideas upon paper, but he seeks the co-operation of the passengers in working them out. Evidence of this is shown by the display of traffic literature in the boxes to be found on the cars running in the district surrounding Croydon. Two leaflets that are still in circulation, with time tables on the reverse sides, bear the date January, 1916, and on inquiry we find that the ideas contained in "Mutual Traffic Aids" and "Hints to the Travelling Public" have worked out well in practice. Managers who have not yet adopted the system of collecting fares on the platform under suitable conditions will be interested to learn that after a year's experience competent observers sum up the results as "excellent."

"Hints to the Travelling Public" read as follows:—

Pay Fare on Platform.—Top deck passengers are respectfully desired to have, whenever possible, the exact fare ready, and to pay the conductor on the platform and receive a ticket before mounting the stairs. Instructions have been given to conductors to enforce this, especially when passengers board the cars in twos and threes along the road, also to commence collecting fares before the car leaves the terminus.

This practice is very desirable, especially with the restricted lighting, as it retains the conductor on his platform so that he can give better attention to his passengers.

Cars Running Past Passengers.—Many complaints would not arise if intending passengers would signal the cars both early and prominently by holding up their hands before the car is up to them.

Witnesses in Complaints or Accidents.—From time to time incidents occur on the best managed tramways that call for independent evidence. Passengers get off cars before they stop, or cars start too soon; collisions occur; disputes arise, or the staff are uncivil, or passengers overbearing. In each instance the staff are rigidly instructed to send in a full report with names of witnesses, not necessarily eye-witnesses, but someone on the car or near by.

There are invariably two sides to every story, and a few questions on paper or a call enables the management to place the blame and end the matter. Passengers are respectfully asked to give their names and addresses both in the interest of the public and in fairness to the staff concerned.

Subjoined are the contents of "Mutual Traffic Aids":—

1. Have your fare ready, exact amount if possible.
2. Pay your fare on the platform before going upstairs, if by so doing you do not obstruct other passengers.
3. Look before you get off or pass behind the car.
4. Always step off car with the left foot first, facing direction of car.
5. Only smoke behind the trolley mast.
6. Signal the car early and prominently, especially after dark and at stopping places not much used.
7. Collect your parcels, if any, and get ready to leave the car before it arrives at your "stop," but do not get on the step or alight until the car actually stops.
8. Keep your ticket handy for inspector.
9. Give your name and address willingly when asked in case of accidents or disputes.
10. Don't rely on the last car to get you home; it may be full or you may miss it—catch the one in front.
11. Do not overcrowd the cars; if a car is behind time it is bound to be crowded, but the car that follows immediately afterwards will be empty.
12. Tell the conductor where you wish to get off; do not ring the bell yourself unless the conductor is not available. Never at any time signal the car to start; leave that to the conductor.
13. Don't get annoyed if the conductor persists in taking your fare before you go upstairs or before the car leaves the terminus.
14. If you have any comments or complaints to make, please write to the office, giving car number and time, or send your ticket.

ELECTRIC TRACK & ROLLING STOCK IN AMERICA.

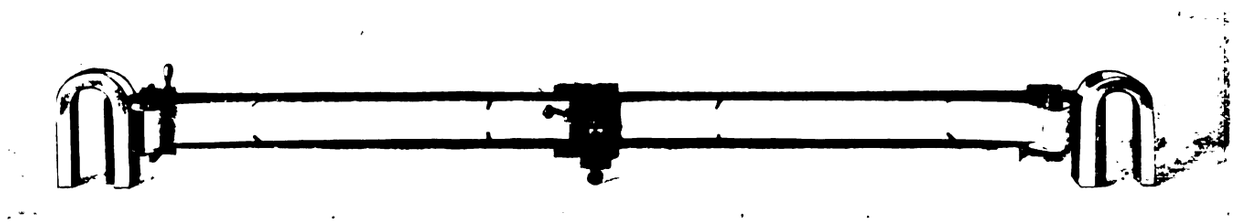
The development of electric traction in the United States, both as regards tramways and railways, goes steadily forward. Statistics published in the *Electric Railway Journal*, New York, show that at midsummer last there were 47,562 miles of electric track, as compared with 46,454 in the preceding year. The number of cars of all sorts was 100,476, against 99,405. The figures include the electrified mileage of steam railroads, but trailer cars on these lines are not included, only the electric locomotives and the electric motor cars being given.

The increase in the length of electric track is also given as for the calendar year 1916, and Canada is included in this latter return. It shows that the single-track mileage of new line built or electrified and placed in operation during 1916 by the electric railways of the United States and Canada amounted to 774. This is materially less than the total of any previous year of which a record has been kept. Out of the total, 388 miles was electrified steam railway track The rest was partly what we call tramways and partly interurban lines. Out of the total, 72 miles are credited to Canada, and the great bulk of this—53 miles in fact—consists of the electrification of part of the Lake Erie and Northern Railway. Practically all the rest of the steam railway electrification work completed during the year is represented by the electrification of the Chicago, Milwaukee and St. Paul Railway, which completed the equipment of 332 miles of track during the twelve months.

In regard to building of new electric rolling stock, it appears that the number of cars ordered or built in railway companies' shops during 1916 was 3,942, being the highest figure for three years.

CORRUGATION RECORDER.

A handy little instrument for measuring and recording the depth of corrugations on the tread of tramway and railway rails has been designed for the use of traction engineers who wish to take permanent records. The instrument is held in position by two heavy magnets at either end. Paper is run from one spool to another at the opposite end. The traveller seen in the centre of the photograph can be moved from end to end, when a pencil makes a record showing the position and the varying depths of the corrugation.



A Corrugation Recorder.

The instrument has been adopted in Australia, where it has been found very useful for securing accurate records. By its use the variations in the corrugations from time to time can be clearly recorded and compared. The recorder is manufactured by the Woods-Gilbert Rail Planer Company, Ltd., 170, Strand, London, W.C.

HADFIELDS LIMITED AND THE U.S.A. NAVY.

The Minister of Munitions has issued a communication stating that his attention has been called to statements which have appeared in the Press to the effect that a contract had been awarded to Messrs. Hadfield for the supply of armour-piercing shells for the United States Navy Department.

The Minister of Munitions desires it to be known that the whole output of steel in the United Kingdom is under his control, and that, so long as the exigencies of the war continue, no permission will be, or can be, given by him to proceed with this work, seeing that it would involve the employment of men and the use of materials for purposes other than those necessary for meeting the needs of ourselves and of our Allies.

The Minister understands that Messrs. Hadfield, when tendering, stated clearly that their offer was conditional upon permission being obtained to manufacture the shells.

MESSRS. TILLING-STEVENS, LIMITED, Maidstone, have sent to their friends a novelty in the form of a "signature blotter," consisting of strips of blotting-paper about 8 in. by 1½ in., secured to an ivory top bearing the calendar for the whole of 1917, and having inches on one margin and centimetres on the other. The top also bears the name of the firm and the words "Commercial motor vehicles."

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GLASGOW CORPORATION TRAMWAYS.

LIQUIDATION OF THE CAPITAL EXPENDITURE.—£119,055 IN HAND FOR RENEWALS.

An important report was presented to Glasgow Corporation Tramways Committee, Councillor Montgomery presiding, on January 31, by Mr. J. Dalrymple, general manager of the tramways undertaking.

As the total amount of the accumulations of revenue invested with the Common Good now exceeded, the report stated, the amount of capital indebtedness, it was proposed to transfer from the depreciation and permanent way renewals fund to the sinking fund such a sum as would make the sinking fund equal to the capital expenditure. The total amount of capital expenditure was £3,835,156. The net amount owing to the Common Good was £2,328,889. The proposal was that this sum should be taken out of the depreciation and permanent way renewals investment account. The total sinking fund already applied in reduction of debt was £1,506,267, which, added to the £2,328,889, would make the total sinking fund £3,835,156, being the amount of the capital expenditure. The effect of this arrangement would be that the sinking fund would equal the capital expenditure, or, in other words, the whole of the debt would be wiped out, and there would remain a balance of £119,055 at the credit of depreciation and permanent way renewals fund.

Mr. Dalrymple thought it would be wise to add to this sum annually out of revenue. He suggested that the following sums might be set aside out of revenue to meet expenditure in renewals:—Permanent way, £39,600 (£200 per mile of single track); power station and sub-stations plant, £13,827 (3 per cent.); cars and electrical equipment of cars, £16,755 (3 per cent.); other rolling stock, £2,790 (15 per cent.); and Clydebank bridges, £550 (5 per cent.); a total of £73,522. The amount proposed to be set aside for the renewal of permanent way was practically the average sum which had been spent annually during the past ten years. In the case of the electrical equipment of the line, it was quite possible to keep up the equipment from year to year directly out of revenue. They had hitherto set aside 2½ per cent. on the cost of the buildings and fittings. As it was unlikely that any of the buildings would require to be renewed for many years to come, and as they were being kept in repair directly out of revenue, it was not proposed to set aside any additional sum for depreciation. One effect of the change would be that the whole debt would be wiped off, and, of course, no further sinking fund would fall to be provided, except for future borrowings. Another effect of the change would be that all borrowing powers, except for future extensions and additions to the plant, would be cancelled. Mr. Dalrymple added that he had gone into the whole question with the engineering staff, and they could see no objection to the change. They were satisfied that the sums proposed to be transferred to the sinking fund were not required for the purposes of renewal and depreciation. They also agreed with the suggestions in regard to renewal for the future. He had also put the whole matter before the auditor, Mr. J. M. McLeod, and he was agreeable to the proposed rearrangement of the finances. Mr. MacLeod was also of opinion that this was the proper time to make the change.

The committee decided to bring the report before the City Council on February 14.

In publishing Mr. Dalrymple's report, the *Glasgow Herald* reminds its readers that the tramways, which had previously been run by a private company, were taken over by the Corporation in 1894, and started as a horse traction system. That system was superseded in 1901 by electric traction. Thus all the capital expenditure which that change involved, as well as the cost of the developments which have taken place in the intervening period, has been wiped out within 16 years, a unique record in the history of tramway undertakings.

WAR TIME TRAFFIC DIFFICULTIES.

BIRMINGHAM.

In connection with a concession obtained in limiting the drawing of the blinds of the cars, the general manager of the Birmingham Corporation Tramways, Mr. A. Baker, has taken the opportunity of informing the citizens of the difficulties that have to be encountered in carrying on the traffic during the war. The difficulties contended with have been very great, apart from the recent curtailment of traffic for several months on account of the conservation of the power supply in the interests of munition factories. Owing largely to the influx of war workers, the cars are carrying 500,000 more passengers per week than before the war, and in order to provide for their transport cars have been taken from the services on the Moseley, Yardley, Stratford Road, Handsworth, and Aston routes. Thus it frequently happens that in the munition districts from sixty to seventy cars may be seen waiting for the accommodation of the workpeople as they leave their employment. Cars remaining on the other services have been overcrowded, and owing to the shortage of men in the repair shops and the lack of motormen the number of cars available has been much below the needs of the traffic. Requests for further facilities are received almost daily from various manufactories, and the Ministry of Munitions, having recognised the importance of travelling accommodation for the workpeople, from time to time support the manufacturers in their demand for extra cars. The public are therefore asked to continue to submit to inconveniences. Another disability is the large number of men who have joined the colours. Before the war 3,000 men were employed. Of these 1,540 have enlisted, 119 of whom have been killed, 209 have returned invalided, and 1,112 are still away. Hundreds of new men have since been employed temporarily until their time came to join the forces, and it is claimed that the entire staff has been changed twice over. Men and vehicles are at work seven days a week. On the conductors' side the mainstay of the undertaking is to be found in upwards of 1,000 women, and there is not one male conductor who is eligible for the army. Valuable service is being rendered by more than 100 volunteer motormen on Saturday afternoons and Sundays, weekday evenings, and in the early morning service.

DONCASTER.

In explaining some of the trials met with at Doncaster, an official of the tramways department has stated that the committee had not made any attempt to keep their men from joining the army. Consequently the present staff of employees is the third that has been trained. Seventy-five per cent. of the drivers and conductors are women, but although they showed great intelligence and staying power, they had not the same idea of punctuality and discipline as men. Hence the regularity of the services suffered. Another outcome of the loss of the services of so many motormen was that the cars could not be kept in the same good order. There were now only twelve motormen, exempted for various periods, to train others, and in time some of them would be called up. Yet another difficulty was created by the extension to Woodlands mining village, thus increasing the track mileage from 9½ to 16, and causing extra wear and tear of the cars. The traffic generally had increased owing to the soldiers in the district and the munition workers, while the general public seemed to travel more than they did before the war. Cars needed to be refitted every two years, but as there was now practically no depot staff the work could not be done. Spare parts were difficult to obtain, and cars had to run until they broke down. Other drawbacks to punctuality were the passage of troops, the breaking down of military wagons on the track or their collision with the cars, and the restricted lighting of the streets and cars. Yet amid all the adverse conditions the tramways during the past six months carried 4,100,000 passengers, as compared with 2,600,000 in the half-year preceding the outbreak of war.

THE MUNICIPAL TRAMWAYS ASSOCIATION.

In consequence of the Bradford Corporation having agreed to lend the services of Mr. C. J. Spencer, the general manager of the tramways, to the Government, it has become impossible for him to continue to act as honorary secretary of the Municipal Tramways Association. At the request of the Executive Council, Mr. A. R. Fearnley, general manager of Sheffield Corporation tramways, has therefore consented to act as honorary secretary for the time being. The registered offices of the Association will remain at 7, Hall Ings, Bradford, and the clerical work in connection with the Association will be conducted from that office in consultation with Mr. Fearnley.

The Annual Proceedings for the year 1915-16 are now available, and may be obtained from the hon. secretary, *pro tem.* (Mr. A. R. Fearnley), Tramways Department, 7, Hall Ings, Bradford, at the price of 5s. The volume contains a full report of the annual conference held in London in September last, at which papers of considerable interest to tramway operators were read, together with other interesting matter. Applications for back numbers of the report should be made to the hon. secretary.

LANCASHIRE AND CHESHIRE ARBITRATION.

The Committee on Production, on January 8, published the result of the arbitration conducted by Sir George Askwith between municipal tramway authorities of Lancashire and Cheshire and their employees. As a result a war bonus of 6s. 6d. per week has been granted to the male tramway employees of fourteen Lancashire towns alone, that amount to include any increases granted since the outbreak of the war. Youths under 18 are to receive a war bonus of 3s. 3d. The award makes no change in the wages or war bonus paid to female employees. Among the areas affected are Salford, Birkenhead, Stockport, Oldham, Preston, Wigan, Bolton, Ashton-under-Lyne, and Accrington.

Certified Occupations.—A notice issued on January 30 stated that the list of certified occupations, dated November 20, 1916, has been revised with a view to releasing more men for the army. The chief alteration is the removal from the list of men classed as B1 (garrison service abroad) who fall below the age limits stated in the list.

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SUPPLY OF CARS, PARTS AND TIRES

The following letter has been received from the Director of Munitions Railway Transport, Ministry of Munitions of War, 28, Northumberland Avenue, W.C., by the Secretary of the Tramways and Light Railways Association, who appeals to members, in order to meet the wishes of the Ministry, as expressed therein, to send to the Association at Sanctuary House, S.W., as soon as possible, full particulars of any materials, cars, etc., which they may have for disposal:—"Numerous applications are being received from tramway undertakings for priority certificates for new tramcars and materials in connection with the maintenance of tramways. The Ministry of Munitions feels it need not emphasise how very important it is in the present circumstances that the strictest economy should be exercised in this direction, and considers before it issues such certificates every effort should be made to supply the applicants with materials or vehicles other tramway undertakings may have for disposal. It has been ascertained in some instances there are vehicles and materials for disposal in the country, but in order to co-ordinate the information the Ministry would value your assistance in the matter, and I am therefore directed to ask whether you could obtain from the tramway undertakings in your association details of the materials and vehicles, if any, they could dispose of."

With reference to the arrangement made in 1915 between the Municipal Tramways Association, the Tramways and Light Railways Association, and the manufacturers of steel tires, Mr. Albert Good, of the Cyclops Steel and Iron Works, Sheffield, on December 20, 1916, sent the following communication to the secretaries of the two associations:—"I beg to inform you that the makers of tires do not propose to modify the prices for the ensuing quarter, and the current figures will therefore hold until the end of March next. I am, however, requested to state that, in consequence of the obvious and inevitable bad state of the roads throughout the kingdom through lack of rails and labour necessary to their upkeep, which must become worse; also the fact that shortage of labour must, and does, prevent the tires being turned up when normally they should be in order to obtain satisfactory mileage, the makers consider it would not be reasonable that the usual guarantee of 5,000 miles per ⅛ in. wear should be expected with the tires, and, henceforward, they will not be able to accept that condition."

TRAMWAYS IN JAPAN.

The Japanese tramways date back from 1880, when in February an application was tendered for the construction of the Tokyo Horse Tramway Company's line. The application was sanctioned, and the line was completed and opened for traffic in June, 1883. This was soon followed by others in rapid succession, and especially since 1888 every year witnessed application for four or five horse tramway undertakings. The result was the promulgation of the Tramway Regulations by Law No. 71, on August 23, 1891, by virtue of which horse tramways and similar means of transportation to be laid on public roads for general traffic came to be authorised subject to the special sanction of the Minister of Home Affairs. On October 22, 1908, it was further provided by Imperial Ordinance No. 266 that applicants for the construction of tramways on the Tramway Orders should also obtain the sanction of the Minister of Communications, whereupon the control of the tramways as to their construction and working came under the charge of the Imperial Government Railways. The *Far Eastern Review* gives the following particulars for the year 1915:—

	Electric.	Steam.	Petroleum.	Horse.	*Rikisha* Tramways.	Total.
Number of tramways	55	23	1	35	12	126
Mileage: Open	565·28	203·34	29·51	269·72	70·64	1,138·49
Mileage: Under construction	262·11	66·95	9·84	19·46	1·41	359·77
Capital (*yen**)	249,297,380	5,170,000	1,000,000	2,163,060	601,500	258,231,940
Cost of construction (*yen*)	242,007,716	5,042,808	1,121,536	2,288,212	650,522	251,110,794
Rolling Stock: Locomotives	3	116	55	1	—	175
Rolling Stock: Carriages	3,506	196	30	535	96	4,363
Rolling Stock: Wagons	184	251	105	587	430	1,557
Staff	20,610	1,003	247	1,374	625	23,859
Passengers carried: Number	558,431,796	6,384,694	1,907,730	9,212,380	293,174	576,229,774
Passengers carried: Earnings (*yen*)	22,454,673	698,820	142,797	631,844	29,080	23,957,214
Goods hauled: Tonnage	420,017	205,694	47,269	229,829	285,460	1,188,269
Goods hauled: Earnings (*yen*)	239,759	119,617	37,996	190,885	157,144	745,401
Revenue (*yen*)	31,061,976	1,085,414	195,197	887,340	350,511	33,580,438
Expenses (*yen*)	21,635,020	808,684	127,029	788,604	298,604	23,657,945
Profit (*yen*)	9,426,956	276,730	68,168	98,732	51,907	9,922,493
TRAMWAYS NOT YET OPENED FOR BUSINESS.						
Number of tramways	26	9	—	16	8	59
Mileage of lines sanctioned	247·47	50·51	—	110·21	26·69	434·88

* The value of the *yen* is 2s. 0⅜d.

EDINBURGH TRAMWAYS.

THE CORPORATION ACCEPT THE COMPANY'S OFFER.

At a meeting of the Edinburgh Town Council on January 16 the Tramway Committee's recommendation to accept the proposals of the Tramway Company was approved. The company has offered to sell the 200 cars for £50,000, and to undertake certain obligations as to upkeep of the lines, etc., until the termination of the lease. In moving the acceptance of the proposals, Mr. Harrison, convener of the Tramways Committee, said that the power-stations, engines and rails belonged to the Corporation, having cost in all about 1½ millions. The rolling stock was the property of the company. The lease bound the company to hand back the system to the Corporation on July 1, 1919, in good tenantable condition, but it did not require the Council to purchase the rolling stock. As regards future plans, the committee had to consider the absolute block put on all construction work by the Ministry of Munitions. The price asked for the cars seemed equitable. On May 29, 1915, the committee obtained a valuation of them as for delivery on July 1, 1919, of £54,000 from Mr. J. B. Hamilton. Under the present circumstances Mr. Harrison was sure that acceptance of the company's offer was the course which the Council should adopt, although it would mean that consideration of the experts' report on the future of the tramways would be deferred. The cable tramways would be continued for some time to come, and if properly kept up and carefully run the system would be quite serviceable. He believed that the present manager of the company was anxious to work the tramways in such a manner as to be a credit to the company and himself, and in spite of the war conditions to make them satisfy the public. The Lord Provost expressed the hope that the committee would continue in the same pleasant relations with the company as now exist.

SIR ALBERT STANLEY'S APPOINTMENT.

AMERICAN APPRECIATION.

In its issue of December 16, *The Electric Railway Journal*, New York, referring editorially to the appointment of Sir Albert Stanley to be President of the Board of Trade, says:—

The appointment of Sir Albert Stanley to the British Cabinet is a well-merited recognition of his executive ability in the conduct of the transportation system in London, and through him the electric railway industry in both continents is honoured. This appointment also emphasises the difference in public rewards, in this country and abroad, accorded to men having the ability to conduct large public utility affairs successfully. Under British rule, for example, honour for signal service along such lines is not uncommon. To cite a few instances, there is Sir Albert himself, as well as Sir Thomas Shaughnessy, Sir William MacKenzie, Sir William Van Horne, Sir Donald Mann, and Sir Clifton Robinson, all of whom served the Empire through their development and direction of large railway affairs. Here, on the contrary, as is well known, the existing public attitude usually puts railway men on the defensive, and active leadership in a railway corporation instead of being accepted as a reason for elevation to high political office is often considered by the public as an argument against it. This is not right. The man who makes an important addition to the transportation facilities of the country, or who, by his successful management, makes such a system of greater use to the public, confers a benefit upon the community which he serves, and, if he was called to political office, we are sure he would serve the public with the same energy and ability that he gave to corporation affairs.

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SALFORD TRAMWAYS WOMEN INSPECTORS.

AWARD OF COMMITTEE ON PRODUCTION.

The following finding, dated January 19, is in respect of a difference that had arisen between the Tramways Committee of the Salford Corporation and the Amalgamated Association of Tramway and Vehicle Workers, relative to the employment of females to carry out certain specified duties as inspectors on the cars. The Committee on Production state :—

"The Tramways Committee of the Corporation of Salford have introduced female conductors on the cars since the beginning of the war, in the necessities which brought about a shortage of male labour, and they now employ about 300 female conductors. Prior to the present difficulty arising there were also two female inspectors, whose services were confined to the supervision of the female conductors when taking up and leaving duty at car depots or sub-offices.

"Owing to the crowded state of the cars running in the inner circle of the borough at certain periods, it was found that the female conductors had frequently difficulties in collecting the fares. Complaints on this subject were made to the Tramways Committee, who decided upon the appointment of a few female inspectors whose duties would be confined to assisting (in rotation) in work at the depot and to boarding cars having female conductors, for the purpose of examining tickets and giving general assistance at the back of the cars to the female conductors.

"The female inspectors were not intended to discharge the whole of the duties of male inspectors ; they were not required to board cars with male conductors, nor to drive a car, nor to conduct running repairs. Their remuneration was fixed at 30s. per week, as compared with a scale of 37s., 38s., and 39s. 6d. for male inspectors, exclusive of war bonus.

"It was not proposed by the Tramways Committee to reduce the number of male inspectors or to leave vacancies among the male inspectors unfilled, if such should arise. In all eight female inspectors were appointed, selected from among the conductors.

"Agitation against the introduction of such female travelling inspectors arose soon after their appointment, and on December 19 a strike occurred of the employees of the tramways (male and female) being members of the Amalgamated Association of Tramway and Vehicle Workers.

"No settlement having been arrived at between the parties on this matter, the difference was reported under the Munitions of War Acts, and duly referred to the Committee on Production for decision. Representatives of the parties were heard on January 10, 1917.

"The committee have given full and careful consideration to the statements and arguments submitted to them, and they find that under the conditions arranged by the Corporation, and as a temporary and supplementary measure during the period of the war, the objection raised by the Union to the employment of female inspectors has not been established."

The award is signed by Sir George R. Askwith, Sir David Harrel, Sir George S. Gibb, and Mr. H. J. Wilson, secretary, 5, Old Palace Yard, London, S.W.

FINANCIAL REPORTS AND MEETINGS.

Rio de Janeiro Tramway, Light, and Power Company, Limited, have declared a dividend of 1¼ per cent.

Sao Paulo Tramway Light and Power Co. announce a dividend of 2½ per cent. on the issued common stock.

Liverpool Tramways and Rate Relief.—At their meeting on January 31, the Tramways and Electricity Committee of Liverpool voted £125,000 from the tramways profits and £65,000 from the electricity undertaking in relief of the rates.

Birmingham Tramways Loss.—Owing to the recent restriction of the tramways service due to the breakdown at the generating station, Birmingham Tramways Committee decided on January 31 that they could make no contribution this year to the relief of the rates. The restricted service entailed a loss of £50,000.

Coventry Chain Company.—The directors report that they are unable to submit the accounts usually presented to the annual meeting, but they are satisfied upon the report of the auditors that the company has made sufficient profit to justify them in recommending a dividend of 7 per cent., less income tax, on the ordinary shares, making 10 per cent. for the year, and a bonus of 5 per cent. less tax.

New South Wales Railways and Tramways.—The report on the working of the Government railways and tramways for the quarter ended September 30 last shows :—Revenue from railways, £1,961,396 an increase of £119,056 compared with the corresponding quarter of 1915, and expenditure £1,414,395, an increase of £150,039. Revenue from tramways, £482,337, an increase of £19,824, and expenditure £394,045, an increase of £18,025.

Dublin United Tramways.—The directors of the Dublin United Tramways Company (1896) have recommended the payment of a dividend of 6 per cent. per annum, less tax, on the preference and a final dividend of 5 per cent., less tax, on the ordinary shares for the half-year ended December 31 ; £20,000 are set aside towards renewals of rails, and £7,000 towards reserve and renewal fund, £13,359 being carried forward. The dividends are the same as a year ago.

Halifax Corporation Tramways.—The annual report shows a total revenue of £113,602, and working expenses £72,245, leaving a gross profit £41,356, compared with £39,666 in the previous year. After deducting interest, £9,832, and contributions to sinking fund, £12,469 4s. 4d., the net profit was £19,055, as against £16,211 in the previous year. Twenty-one million twenty-four thousand and three passengers were carried, as against 20,707,071 in the previous year, equal to carrying the whole of the population 119 times during the twelve months. The cars were used free by 3,192 blind persons. The route mileage is 37 miles 935 yards (23 miles 1,367 yards inside, and 13 miles 1,328 yards outside the borough), equal to 55 miles 867 yards of single track. The capital account now stands at £420,406, and £1,705 was spent during the year. The mortgage debt, after deducting loans repaid, stands at £269,385.

Sheffield Tramways and Omnibus Estimates.—Mr. A. R. Fearnley, general manager, Sheffield Corporation Tramways, has presented the estimates of the income and expenditure of the tramways and motor omnibus department for the year ended March 28, 1918. Omnibuses : Estimated receipts, £34,650 ; bank interest, £200 ; total, £34,850 ; estimated working expenses, £30,700 ; charges for sinking fund and income tax, £2,017 ; renewals fund, £3,800. Total estimated receipts, £34,850 ; total estimated expenditure, £36,517 ; deficiency, £1,667. Tramways : Working expenses, £354,166 ; war allowances, £12,500 ; interest and sinking fund on loans, £68,972 ; interest and sinking fund on street improvements, £8,500 ; income tax, £25,800 ; transfer to renewals fund, £34,000 ; transfer to special purposes fund, £2,000 ; total, £505,938. The total estimated receipts are £523,683, and the net balance £17,745.

Blackpool, St. Annes, and Lytham Tramways Company.—Mr. G. Nicholson presided at the annual meeting and moved the adoption of the report, which stated that the year's working was highly satisfactory, and had enabled the directors to recommend a distribution of the full year's interest of 5 per cent. upon the debenture stock, this being an account of the arrears due to date. The chairman stated that the directors were in negotiation with the Corporation of Blackpool regarding the continuation of the running powers. The cost of materials had increased to a very great degree, and the tendency was towards still higher prices. The question of labour had been a difficult one. Of the old traffic staff only ten men were left. All the cars were now in charge of women conductors. While they had proved satisfactory, they were more expensive than men, and had not sufficient physical strength for some of the work. The number of passengers and the net result constituted a record, and this was the first year in which the net balance of revenue had been sufficient to meet debenture interest in full. In the near future it would be necessary to have additional cars to cope with the traffic, and it would be desirable to have tops on the existing cars for night and smokers' use. Mr. T. M. Smith was re-elected a director.

Yorkshire (West Riding) Electric Tramways Company.—Sir Herbert S. Leon presided at the annual meeting, which was held on January 19 in London. In moving the adoption of the report the chairman said that the income amounted to £90,363, including £88,329 traffic revenue, and the expenditure to £47,473. The net income was £26,188. Tramway receipts had grown steadily from £38,051 in 1905. Passengers totalled 12,888,274, compared with 11,602,483 in 1915. The mileage run was 1,768,007, against 1,763,702. The additional expenditure more than counter-balanced the increase in revenue. The accounts showed a divisible balance of £41,233 (including £15,045 brought forward) and a dividend of 6 per cent. on the cumulative preference shares was proposed and adopted. A scheme was accepted for funding the arrears of dividend to December 31, 1916, on the 6 per cent. cumulative preference shares. Funding certificates will be issued, and after paying the full dividend on the preference shares accruing in future, the certificates will be paid off out of the surplus profits. The chairman said each holder of a £5 preference share would receive new stock for arrears in the following proportion :—Shares issued in August, 1905, £2 3s. 2d. ; in September, 1905, £2 2s. 7d. ; and in November, 1905, £2 1s. 11d. ; the total amount being £99,703. In round figures the holder of 35 preference shares would get £75 new stock. The report for the year ended December 31, 1916, shows that after providing for all expenses, including repairs, maintenance, and debenture interests, there is a net income of £26,188. Including £15,045 brought from last year the available balance is £41,233, which has been appropriated as follows :—Dividend on the 6 per cent. cumulative preference shares, £10,755 ; depreciation, renewals, and reserve fund, £12,525 ; leaving £17,952 to be carried forward. The number of passengers carried, 12,888,274, shows an increase of 1,768,007, as compared with the previous year.

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Edinburgh and District Tramways Company.—The following summary gives the results for the last financial year and comparative figures for the three previous years :—

	1916.	1915.	1914.	1913.
RECEIPTS—				
Passenger fares	£312,211	£303,985	£307,148	£288,656
Other traffic receipts	3,275	4,377	3,341	3,631
Interest	1,781	2,506	1,982	2,288
Rent, etc.	602	1,009	519	527
	£317,869	£311,877	£312,990	£295,102
EXPENDITURE—				
Traffic expenses	£68,245	£64,240	£65,143	£61,592
Motive power expenses (cable) ...	38,074	23,460	23,692	22,655
Motive power expenses (electric)	608	663	629	654
Maintenance	72,197	46,745	42,097	39,308
Lighting, cleaning, and oiling ...	8,090	6,370	5,964	5,726
Cleaning lines and cable tubes and sanding	3,077	1,605	1,593	1,555
Uniforms, etc.	1,444	1,680	1,696	1,381
General charges	23,846	24,819	22,504	22,976
Rent of tramways	104,750	105,737	105,144	105,073
Feu duties, taxes, etc.	8,139	8,438	8,210	7,605
	£328,470	£283,757	£276,672	£268,525
Profit	—	£28,120	£36,318	£26,577
Loss	£10,601	—	—	—
Mileage open	25¼	25¼	25¼	25¼
Miles run	6,124,253	6,437,644	6,663,981	6,477,461
Passengers carried (including estimate for season tickets)... ..	61,579,430	66,516,137	67,602,916	63,622,376

In their report for the year ended December 31, 1916, the directors state that negotiations are in progress between the Corporation and the company in regard to the purchase of the company's cars and plant at the expiry of the lease in 1919. Mr. J. D. R. Cox, general manager and engineer, states in his report that the cars and other rolling stock, car department machinery, and other working plant, cables, permanent way, and power plant have been thoroughly overhauled during the past year, and are now in first-class condition. These repairs have necessitated a very heavy expenditure, but the results throughout the remainder of the lease will justify the outlay.

Dublin United Tramways Company.—The report for the year ended December 31, 1916, is summarised below in comparison with the three preceding years. The amount available for division at December 31 last was £91,194. Interim dividends amounting to £24,960 were paid in August last, leaving a balance of £66,234. The directors recommend a dividend of 6 per cent. per annum, less income-tax, on the preference shares for the half-year, and a final dividend at the rate of 5 per cent., less income-tax, on the ordinary shares for the same half-year, setting aside £20,000 towards the renewal of rails and adding £7,000 to the general reserve fund. These appropriations absorb £77,835, leaving £13,359 to be carried to the next account.

	1913.	1914.	1915.	1916.
RECEIPTS—				
Traffic receipts	£284,816	£306,083	£317,762	£319,612
Parcels delivery	5,769	7,129	7,467	6,987
Advertisements	4,132	4,969	4,143	3,980
Carriage of goods	1,025	1,551	1,874	2,094
Other receipts	1,989	2,164	2,653	2,662
Total receipts	£297,731	£321,896	£333,899	£335,335
EXPENSES—				
Working and general	£172,604	£184,625	£201,836	£213,587
National Insurance	881	945	961	915
Repairs to cottages	700	868	1,235	1,191
Parcel delivery	3,102	3,934	4,400	4,143
Goods carriage	572	868	951	1,025
Total expenses	£177,859	£191,240	£209,383	£220,861
Balance on working	£119,872	£130,656	£124,516	£114,474
Balance from last account ...	11,258	9,958	11,366	13,045
Interest	1,982	2,076	1,902	1,650
Total balance	£133,112	£142,690	£137,784	£129,169
DEDUCTIONS—				
Interest on debentures, etc. ...	£26,373	£26,856	£25,421	£22,868
Wayleaves	15,241	14,427	13,518	12,107
Payment to Howth Company ...	3,000	3,000	3,000	3,000
Renewals at sub-stations	458	360	—	—
	45,072	44,643	41,939	37,975
Balance available for division ...	£88,040	£98,047	£95,845	£91,194
Div. on Pref. shares, 6 per cent. for year	£33,900	£33,225	£31,200	£27,900
Interim div. on Ord. shares for half-year	18,645 (6 p.c.)	15,469 (5 p.c.)	14,781 (5 p.c.)	10,560 (4 p.c.)
Final div. on Ord. shares, 5 per cent. for half-year	15,537	14,987	13,819	12,375
Reserve for renewals of permanent way...	7,000	18,000	18,000	20,000
Reserve and renewals fund ...	3,000	5,000	5,000	7,000
Balance to next account	9,958	11,366	13,045	13,359
	£88,040	£98,047	£95,845	£91,194
Car mileage	7,175,852	7,690,656	7,881,938	7,440,614
Energy consumption	11,671,048	12,499,453	13,277,831	13,007,405

Wolverhampton Corporation Tramways.—The gross profit for the year ended March 31 last amounted to £26,853, which included £1,459 on the motor chars-a-banc account. Net profit was £6,496, of which £4,018 has been contributed in aid of rates, and £2,478 has been carried forward to meet cost of repair work in 1916–17. A summary of the results for the past three years is appended :—

	1915-16.	1914-15.	1913-14
Capital expenditure	£294,046	£292,361	£287,569
Amount outstanding	£203,651	£209,497	£215,166
Traffic revenue	£58,531	£54,593	£56,444
Total revenue	£59,111	£55,323	£57,203
Working expenses	£33,156	£34,595	£33,126
War allowances	£1,062	£461	—
Gross balance	£24,893	£20,257	£24,077
Net profit	£6,496	£3,744	£5,553
Passengers carried	13,296,146	12,236,785	12,616,881
Fare per passenger	1·05d.	1·06d.	1·07d.
Car mileage	1,156,591	1,181,309	1,195,326
Units per car-mile	1·56	1·45	1·54
Power cost per car-mile ...	1·573d.	1·463d.	1·513d.
Traffic receipts per track-mile	£2,660	£2,539	£2,625
Traffic receipts per car-mile ...	12·145d.	11·091d.	11·333d.
Expenses per car-mile ...	*6·880d.	*7·030d.	6·651d.
Ratio of working expenses ...	56·09%	62·5%	57·9%
Total track mileage	22 miles	21½ miles	21½ miles
Number of cars in stock ...	52	52	52

* Exclusive of War Service allowances to employees.

Oldham Corporation Tramways.—The 15th annual report, dealing with the year ended March 25 last, shows a considerable improvement on the result of the previous year's working. For 1914-15 there was a deficit of £5,217, but for the past year there was a net profit of £4,112. Subjoined is a comparative statement extracted from the returns for the past three years :—

Year ended March 31	1916.	1915.	1914.
Capital expenditure... ...	£460,831	£453,655	£444,565
Amount outstanding ...	£292,953	£303,738	£311,148
Traffic revenue	£118,339	£111,679	£114,481
Total revenue	£121,129	£113,814	£116,170
Working expenses	£76,365	£82,963	£78,303
War allowances	£5,225	£2,121	—
Gross balance	£39,539	£28,730	£37,867
Net profit	£4,112	£5,218	£4,901
Passengers carried	23,477,066	22,171,712	22,773,108
Fare per passenger	1·19d.	1·19d.	1·19d.
Car-mileage	1,983,607	2,045,840	2,077,104
Units per car mile	1·568	1·544	1·585
Power cost per car-mile ...	2·352d.	2·316d.	2·376d.
Traffic receipts per track-mile	£3,198	£3,018	£3,136
Traffic receipts per car-mile	14·318d.	13·101d.	13·228d.
Expenses per car-mile ...	9·871d.	9·981d.	9·047d.
Ratio of working expenses	67·35	74·75	67·40
Total track mileage ...	28 m. 49 ch.	28 m. 32 ch.	28 m. 6 ch.
Number of cars in stock ...	108	97	92

The motor omnibus account shows a balance of £143 carried to net revenue account. Allowing for interest on loans and contribution and interest to sinking fund, there was a deficiency on this account of £718.

Cardiff Corporation Tramways.—The annual report for the year ended March 25, 1916, shows that the Cardiff Corporation electric lighting and tramways department has had what must be described as a very prosperous year. The expenditure has decreased by £6,627, mainly owing to the reduced number of employees, while the revenue has increased by £3,111, giving an increase in the net revenue of £9,738. The traffic throughout the year has shown a steady increase. The cost of supplies has, of course, largely increased, and the price of coal has been affected by the additional charge of 2s. 6d. per ton sanctioned by the Board of Trade under the Coal Prices (Limitation) Act. A summary of the results for the last three years is appended :—

	1915-16.	1914-15.	1913-14.
Capital expenditure	£813,850	£811,043	£786,510
Amount outstanding ...	£455,296	£485,049	£514,049
Traffic revenue	£140,876	£138,672	£141,519
Total revenue	£167,794	£164,683	£166,200
Working expenses	£90,733	£97,360	£99,064
Gross balance	£77,061	£67,323	£67,136
War allowances	£5,326	£2,655	—
Net profit	£20,525	£16,949	£18,594
Passengers carried	30,878,116	30,424,407	31,122,962
Fare per passenger	1·09d.	1·09d.	1·09d.
Car mileage	2,399,240	2,742,546	2,966,230
Units per car mile	1·47	1·80	1·71
Power cost per car mile ...	·736d.	·835d.	·850d.
Traffic receipts per track mile	£4,360	£4,358	£4,464
Traffic receipts per car mile ...	14·09d.	12·14d.	11·45d.
Expenses per car mile ...	7·514d.	7·028d.	6·781d.
Ratio of working expenses ...	52·2	56·9	58·2
Total track mileage	32 m. 25 ch.	31 m. 66 ch.	31 m. 66 ch.
Number of cars in stock ...	130	130	130

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CONTRACTS AND ORDERS.

Hadfields, Limited, have secured a contract for the supply of points and crossings to Johannesburg Tramways.

Colchester Tramways Committee have accepted the tender of Pasley and Company to supply 12 tons of brake blocks.

British Thomson-Houston Company have an order for 50 tramcar motors from Sheffield Tramways and Motors Committee.

British General Electric Company have received a contract to supply 25 transformers to Launceston Council, Tasmania.

Darlington Tramways Committee have accepted the tender of Rego Clothiers, Limited, for the supply of uniforms for the employees.

Aberdeen Tramways Committee have accepted the offer of the British Thomson-Houston Company to supply four electric motors for cars.

Erith Council have placed a contract with Messrs. H. Friday and Sons for the erection of a shelter for tramway passengers in Walnut Tree Road.

Victorian Railways Department have allotted a contract for battery zincs to the India Rubber, Gutta Percha and Telegraph Works Company, Limited.

J. W. Courtenay, Limited, of Amberley House, Norfolk Street, London, W.C., have been appointed sole advertising contractors to the Malta Tramways Company.

New South Wales Public Works Department have ordered 16 direct-current motors and equipment from Harvey and Phillips (for the Brush Electrical Company) at £2,688.

Shepherd's Parging Block Company, Limited, of Milkstone, Rochdale, have recently received orders from Wolverhampton, Rochdale, and East Ham Corporations for parging blocks.

Insurance against Loss of Profit.—Essex and Suffolk Fire Office have received a payment of £67 19s. 3d. by way of premium for insuring Colchester Tramways against loss of profit.

Portsmouth Tramways Committee have made a contract for a supply of tickets for a year at 6d. per thousand, as against the pre-war price of 1¾d. The contractor has the right of advertisements on the back.

The British Westinghouse Company's tender at £20,500 for a 6,000-KW. turbo alternator with condensing plant to be manufactured by the Mirrlees Watson Company at £8,045, has been accepted by Glasgow Electricity Committee.

Bradford Electricity Committee have placed contracts as subjoined:—Three 600-K.V.A. transformers, Brush Electrical Engineering Company; steelwork for runways at Valley Road Works, Redpath, Brown and Company, Limited.

Manchester Electricity Committee have allotted contracts to Erith's Engineering Company, Limited, for an Erith-Riley stoker; to Redpath, Brown and Company, Limited, for steelwork; and to Ferranti, Limited, for two static transformers.

Bradford Tramways Committee, after considering prices submitted in tenders for steel tires, and the conditions required by tenderers, instructed the manager to request the Municipal Tramways Association to take up the matter with the Ministry of Munitions in the interest of public transport.

Melbourne Council have placed the following orders:—Four direct-current motors, British Westinghouse Electric and Manufacturing Company, Trafford Park; insulated copper cables, W. T. Henley's Telegraph Works; six circuit breakers, Edison-Swan Electric Company, Ponders End.

Southend Council have placed the following contracts:—John Brown and Company, tires; P. R. Jackson and Company, armature coils, etc.; S. Stone and Company, bar steel, iron, etc.; Hider Dempster, springs, white metal, etc.; British Thomson-Houston Company, field coils, gear cases, etc.

Surplus Rails at Brighton.—In his last annual report the general manager of Brighton Corporation Tramways congratulated the Tramways Committee upon having secured a large stock of rails when the times were more favourable. The committee have offered 75 tons of rails to Sheffield tramways department at £16 per ton, the purchasers to pay carriage.

Yarmouth Council have accepted the tender of the Punch and Ticket Company for ordinary fare tickets at 7½d. per 1,000, with an extra ½d. for coloured paper and discount, scholars' and workpeoples' tickets at 1s. 6d. per 1,000. These will be subject to a variation of one-eighth of a penny per 1,000 for every £1 per ton paper rises or falls above or below £20 per ton.

Doncaster Tramways Committee have placed an order for the welding of 250 rail joints with the Tudor Accumulator Company, Limited. The decision was arrived at on a report presented by a deputation which inspected work at present being done by the company on the Sheffield tramways. The track has for some time been a source of anxiety to the committee, and during the year ending in March next £5,000 will have been spent on its improvement.

PERSONAL.

Chief Inspector Baker has been appointed traffic superintendent of Doncaster Corporation Tramways. Inspector Fuller has been appointed chief inspector.

Mr. William Hewat has been appointed a director of the Dublin United Tramways Company in place of Alderman W. F. Cotton, M.P., D.L., who has resigned owing to ill-health.

Mr. John H. Bunting, who for the last four years has been joint manager of Bruce, Peebles and Company, Limited, Edinburgh, has been appointed general manager of the company.

Mr. F. H. Corson, general manager of Gloucester Corporation Tramways, and borough electrical engineer, having been overtaken by illness, the council have offered him leave of absence for a complete rest.

Mr. S. E. Bastow, who for the last four years has been joint manager of Bruce, Peebles and Company, Limited, Edinburgh, has accepted the position of chief engineer to British Dyes, Limited. Mr. Bastow's headquarters will be at Huddersfield.

Mr. W. Maltby, inspector of Sheffield Corporation Tramways, has retired after 20 years' service, including 16 as inspector. On behalf of his late colleagues Chief Inspector Shorland presented him with a gold-mounted umbrella and a pipe.

Mr. G. Mure Ritchie, chairman of the Barrow Hematite Steel Company, Limited, and the Millom and Askam Iron Company, Limited, has been elected a director of the Furness Railway Company, in place of the late Mr. W. B. Turner.

Sir James Hill, Bart., was congratulated at the January meeting of Bradford Corporation upon having received a baronetcy in the New Year Honours list. Sir James is chairman of the Finance Committee, and for several years was chairman of the Tramways Committee.

Bristol Tramways and Carriage Company, Limited.—Mr. Samuel White, J.P., has been elected chairman in the place of the late Sir George White. To fill the vacancy on the board, Mr. Sidney E. Baker, of Messrs. Stanley, Wasbrough, Doggett and Baker, has been elected a director.

Western Wagon and Property Company, Limited.—The directors have elected Mr. Samuel White, J.P., chairman of the board in succession to the late Sir George White, and Mr. Sidney E. Baker, of Messrs. Stanley, Wasbrough, Doggett and Baker, has been elected to the vacant seat on the board.

Mr. E. A. Mills, of Birmingham Corporation electricity staff, has been appointed chief engineering assistant of the Leeds Corporation electricity undertaking. There were 78 candidates, and five members of the committee visited Birmingham and Sunderland to secure further information about the two selected candidates. The salary of the post is £350 per annum.

Mr. Edmund L. Hill, manager of the Manchester Branch of Siemens Brothers and Company and Siemens Brothers' Dynamo Works, and hon. secretary of Manchester Engineers' Club, has been appointed secretary to the Federation of British Industries. Mr. Dudley Docker is president of the federation, whose temporary offices are at 51, Lincoln's Inn Fields, W.C.

Imperial Tramways Company, Limited.—Mr. Samuel White, J.P., has been elected chairman in the place of the late Sir George White, and Sir G. Stanley White, Bt., has been elected a director to fill the vacancy caused by the death of the late chairman. Mr. W. G. Verdon Smith, secretary of the company for the past fifteen years, has been appointed managing director, and Mr. F. H. Withers has been appointed secretary in his place.

Mr. J. H. Rothwell, town clerk of Chesterfield, has been presented with a silver salver by the members of Brighouse Town Council in recognition of his services as town clerk. During his term of office he did much to forward the scheme of Huddersfield Corporation to extend their tramways to the centre of Brighouse, and there is no doubt that if the war had not broken out Brighouse would now be connected by tramway with Huddersfield as well as with Halifax.

Alderman J. H. Hargreaves, Lord Mayor of Hull for several years and ex-chairman of the Tramways Committee, from which he retired in consequence of the strain of his mayoral work, has been accorded a vote of thanks by the local committee of the Prince of Wales' Fund for the work he accomplished for the fund. £28,723 were raised, and Mr. T. R. Ferens, M.P., remarked that by his judicious action Alderman Hargreaves was able to relieve many poor distressed people of a serious burden.

Mr. J. Dalrymple and Mrs. Dalrymple were "at home" on the afternoon and evening of January 12 to members and friends of the St. Andrew Society (Glasgow), of which Mr. Dalrymple is chairman of the council. The object of the "at home" was to endow a St. Andrew Society bed in a Red Cross Hospital. Recently Glasgow's popular tramways manager, who has been indefatigable in local war work, presented the certificates gained during the past session by No. 17 Voluntary Aid Detachment.

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Mr. H. W. Laing, general manager and electrical engineer, Blackpool, St. Annes and Lytham Tramways Company, together with the staff, were accorded a vote of thanks at the annual meeting of the shareholders. The chairman remarked that he was a capable and indefatigable manager, who never spared himself, and had worked both early and late during a most trying year. Seventy-six per cent. of the former staff were serving in the army. Five had died for their country, others had been severely wounded, and two had won the D.C.M. The men of the staff left at home had necessarily had an additional burden of work, which had been most cheerfully undertaken. The directors gratefully recognised the whole-hearted way in which they had discharged their duty.

Mr. W. T. Robson, general manager, Southampton Corporation Tramways, was granted an increase of salary from £400 to £500 by the Council at their second meeting in January. Alderman Kimber, in moving the recommendation, said that Mr. Robson was offered a larger salary than he received on appointment to remain at South Shields. He was a master of tramway management and a skilled administrator. Southampton owned one of the few tramway systems in which travelling facilities were greater than before the war. The parcels' carrying system which Mr. Robson had introduced had resulted in an increased revenue of £400 a year. Alderman Hollis mentioned that tramway receipts were up by £6,000 in comparison with last year, which was a record.

NATIONAL SERVICE APPOINTMENTS.

Mr. Johnstone Wallace, an ex-Lord Mayor and chairman of Newcastle Tribunal, has been appointed Deputy Director of the trade section of the department of the Director-General of National Service (Mr. Neville Chamberlain). He will have as immediate chief Sir John Hewitt, who is Director.

Mr. E. A. Prosser, of Cardiff, general manager, Rhymney Railway Company, South Wales, has accepted the position of deputy director of Military Train Movements at the War Office under Sir Sam Fay. Mr. Prosser retains the general management of the Rhymney Railway. He has been 36 years in the company's service, having joined as a junior clerk.

Lord Chilston, president of the Tramways and Light Railways Association, has been serving since the war as chief county director of the Voluntary Aid Movement. After inspecting the Middlesex detachments on January 15, he said it would have been impossible for the Government to have carried through its work but for the voluntary assistance which has been given, and in no case more thoroughly and more effectively than in Middlesex.

Mr. Alfred Ingram, Westminster, who has been Assistant Director at the Ministry of Munitions since June, 1915, has been compelled to sever his connection with the Ministry owing to ill-health. On his retirement he was presented by his staff with a souvenir and received appreciative letters both from the Director and Director-General of the Ministry. After a period of complete rest Mr. Ingram hopes to resume the direction of his railway supply business.

Sir Sam Fay, general manager, Great Central Railway, has been appointed to the control of the military and munition train movements in this country, under the Department of Military Railways, of which Sir Eric Geddes is in charge, with headquarters in France. Sir Sam Fay, who received his knighthood in 1912, has been at the head of the Great Central Railway since 1902. He entered the service of the London and South-Western Railway as clerk in 1872.

The Hon. Arthur Stanley, chairman of the British Red Cross Society, addressing the West Lancashire Committees of the Red Cross Society on January 13, said it was only a little more than two years ago that he got permission from Lord Kitchener to send the first motor ambulance to France, and now the fleet of motor ambulances numbered well over 2,500. Within the last few days he had discussed with Lord Derby and Mr. Barnes the question of continued treatment in hospital for such discharged disabled men as needed it, and he had reason to believe it would be arranged.

Tramway Managers in National Service.—At the urgent request of the Admiralty, Mr. J. B. Hamilton, general manager of Leeds Corporation Tramways, Mr. J. M. McElroy, general manager of Manchester Corporation Tramways, and Mr. C. J. Spencer, general manager of Bradford Corporation Tramways, have been released from their duties by their respective Corporations for the duration of the war, in order that they may take up important posts in the new department for organising labour in the shipyards and marine engineering works. This department is being organised under the direction of Mr. Lynden Macassey, K.C., and will have its headquarters at Horrex's Hotel, Norfolk Street, Strand, London, W.C.

WITH THE FORCES.

Mr. A. E. Prescott, borough surveyor of Eastbourne, has been appointed major in the Roads Battalion for service in France.

Mr. W. Gilbert, of the Hoyt Metal Company of Great Britain, Limited, has joined the Artists' Rifles Officers' Training Corps.

Mr. J. Johnson, borough surveyor of Rawtenstall, has received a commission as captain in one of the Lancashire Companies of the Roads Battalion.

Gunner H. Ratcliffe, R.G.A., who has been recommended by his commanding officer for a commission, was a motorman on Burnley Corporation Tramways.

Major J. H. Dobson, who commanded the Pioneer Corps in the expedition against the Germans in Africa, has been awarded the D.S.O. Major Dobson is general manager of Johannesburg Corporation Electricity and Tramways undertakings.

Sergeant H. Fernhead, a Blackburn conductor, who enlisted in September, 1914, at the age of 19, has during the interval served in Egypt and Gallipoli, where he had several narrow escapes. Returning to Egypt as a corporal, he was trained with the machine gun section, qualified as an instructor, and was promoted sergeant.

Alderman J. H. Palin, secretary to the Bradford branch of the Tramways and Vehicle Workers' Union, and who has served as a member of the Tramways Committee, has received an appointment on the transport staff of the army. Mr. Palin was formerly a railway employee, and for several years he has been Labour candidate for East Bradford. Trade unions dealing with transport matters have been asked by the authorities to free suitable officials for work in this department. Mr. Palin will, it is understood, act as traffic inspector on the railway with the rank of corporal. He has two sons serving in the army, and he himself has served in the new Volunteer Force in Bradford. Mr. A. Henderson, M.P., is amongst those who have congratulated Mr. Palin on the step he has taken.

Municipal Engineers and the War.—In the inaugural address of Mr. E. Whitwell (Aberscychan), the new president of the Institution of Municipal Engineers, which was read in his absence on naval service, the author said:—"You have contributed to Britain's wonderful and mighty army men without whom success could never be achieved; men who in civil life were leaders of her engineering faculties, and who are now, from private to general, silently, nobly, and heroically striving together to reach the inevitable goal of victory, a victory which shall remove from Europe the possibilities of that menacing militarism which always finds its beginning in peaceful defence, but its end in frightful offence. Your roll of honour has upon it the names of men who have sat by our sides, and who have laboured with us for the advancement of the sciences of engineering, who to-day lie cold on the field of battle. As England is richer by their noble sacrifice, we realise that she is poorer by their early death, for they counted among our most brilliant and learned members. Some of them, had they been used to better purpose, might have served England to better success—the greatest lesson of the war."

Lieutenant Enrico Daverio, who had won the Italian M.C., and has since died of wounds sustained in action with the Italian Army, was a member of the staff of the drawing office in the tramway department of Messrs. Edgar Allen and Company, Limited, of Sheffield.

The Sheffield Corporation Tramways and Motors Committee have decided to increase their subscription to the Engineering Standards Committee from £5 5s. to £10 10s. per annum.

Scope for Tramways in Russia.—Of the 1,231 municipal areas in Russia only 54 have a service of tramways, some of which have horse-drawn cars. One hundred and sixty-two areas are lighted by electricity.

Inspectors and Military Service.—The *Glasgow Herald* reports that the decision of the Central Military Tribunal has been issued with reference to an appeal by the military representative against the decision of the Lanarkshire Appeal Tribunal in the case of a tramway ticket inspector. The County Tribunal decided that the inspector was engaged in a certified occupation, and this finding has been upheld by the Central Tribunal, which has granted him exemption conditional on remaining in his present occupation. We may add that the regulation on the matter refers to "traffic inspector."

German Traffic Organisation.—In consequence of the pressure on the railways and the shortage of fuel and rubber for motor lorries, tramway undertakings in Germany have been asked to run trailers for the conveyance of goods, especially where the lines connect with railway stations. The Berlin cars are conveying food to the various barracks. The Berlin newspapers complain of the confusion and waste of time caused by the recent reduction of the railway and tramway services, and the authorities appear to be dissatisfied with the results of efforts to promote economy in the use of electricity for light and energy. The Ministry of the Interior have circularised business firms and factories with a view to obtaining an unbroken working day, by doing away with the mid-day meal hour. It is suggested that work should stop at 4 p.m. At present shops are compelled to close at 7 p.m. Another suggestion is that by freeing the Berlin tramways from the mid-day rush traffic women will not have to stand so long outside the food shops.

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TRAMWAY AND LIGHT RAILWAY NOTES.

BIRMINGHAM.

TRAILER OPERATION—SUGGESTED SUBWAYS FOR THE CENTRE OF THE CITY—PROSECUTION TO PREVENT OVERLOADING.

The Tramways Committee on January 23 considered the general manager's report on the experiment in running single-deck motor cars and trailers during the past year. A number of difficulties have been overcome, and the committee agreed to one route being entirely equipped for trailer operation as soon as possible. After a trial of the proposed service the committee will consider the desirability of recommending the Corporation to adopt trailers generally. An illustrated account of the Birmingham experiment was published in our issue of January 11.—The magistrates on January 19 imposed a fine of 20s. on a man who had entered a tramcar which had the chain across the platform, the car being full at the time. The defence was that there were three vacant seats on the top, but the Corporation solicitor stated that though there were vacant seats on the balcony outside, the car had its full number of passengers, some of whom were standing. There was such a thing as specific gravity, and it was undesirable that a car should be overloaded.

BLACKPOOL.

TRAMWAY EXTENSIONS.

A bill to be promoted by the Corporation of Blackpool in Session 1917 seeks powers to alter the boundaries of the borough and to construct additional promenades and 1 mile 5 furlongs 3 chains of double and 1 furlong 3 chains of single line tramways.

BRADFORD.

TIMELY REMINDER TO PASSENGERS.

The chairman of the Tramways Committee, Mr. Enoch Priestley, in reply to some complaints at the last council meeting, put the present tramways situation in two sentences :—" How to provide every passenger with a seat was a vexed question, and so long as humanity remained what it was, and people wanted to get home quickly, the difficulty would probably remain. The department could do better if it had more men and more cars ; but we were passing through a war period, and the public must not expect for their penny all the comforts of a carriage and pair." It would be useful if these two sentences could be printed in large type and hung in every Town Council chamber.

CARLISLE.

TRACK AND ROLLING STOCK.

Carlisle Watch Committee have directed the attention of Carlisle Tramways Company to the unsatisfactory state of the track and rolling stock. The committee have reported to the council that the time must shortly arrive when very drastic steps must be taken.

DONCASTER.

OBTAINING PARTS FROM CARS LAID BY.

In consequence of Doncaster Tramways Committee having been unable to obtain five new cars, the department has had to pull some of the present cars to pieces in order to get parts for the repair of others.

HUDDERSFIELD.

EXTENSIONS REQUIRED—RAILLESS TROLLEY CAR SCHEME—GREAT ADDITION TO POPULATION—STOPPING PLACES.

With the advent of British Dyes, Limited, to Huddersfield, and the opening of two other large works, including a Government factory, there has been a great addition to the population. To provide for their needs, and the wants of the borough generally, the Corporation propose to erect working class dwellings at the cost of £250,000 ; to improve and pave a number of main roads and to construct two new roads at an outlay of £208,000 ; to construct new sewers and to build new schools, public baths, and a laundry. Tramway extensions and renewals are also contemplated as follow :—Doublings and renewals, £87,418 ; extension to Brighouse, £63,000 ; extensions at Longwood, Crosland Mill, Dalton, Ramsden Street, railless trolley cars from outlane to borough boundary, £60,000 ; total, £210,418. The aggregate cost of all the schemes is £957,058, and in order to forward the housing scheme a deputation has been appointed to wait on the Ministry of Munitions. A sub-committee of the Tramways Committee has been appointed to deal with the question of stopping places on all sections.

LEEDS.

RESTRICTED FREE RIDING FOR SOLDIERS.

Under an arrangement made in October, 1914, Leeds Tramways Committee allowed free travelling to soldiers and sailors, wounded or well, between 7.30 a.m. and 9 a.m., 12 p.m. and 2 p.m., and 4.30 p.m. and 6 p.m., a total of five hours. The committee have now decided to give free conveyance to soldiers in uniform from noon to 4.30 p.m., and though this reduces the free period by half an hour, it is at a time of the day when it is most useful for the conveyance of civilians.

LONDON.

IMPENDING L.C.C. REORGANISATION—300 CARS LAID BY—CRITICISM OF THE POLICE—INCREASED CONSUMPTION.

With a certain amount of traffic diverted from the railways by the 50 per cent. increase in fares, and by the closing of several stations south of the Thames, the pressure on the southern portion of the London County Council Tramways has become very marked at the rush periods. Complaint was made at the meeting of the Council held on January 23 that fifty breakdowns were reported between January 3 and 19, some of them occurring in the busiest hours. Mr. H. H. Gordon, deputy chairman, reminded the critics that they had made too little allowance for war conditions, and said that 16 to 20 per cent. of the services had to be cut down through the deficiency of labour. Mr. G. H. Hume, chairman of the Highways Committee, observed that while the management fully realised the deficiencies, the public ought to be thankful that the cars could still run at all. The committee believed that by internal re-organisation they could do something. He hoped when the committee came before the Council in a few weeks with alterations which might involve cost, the Council would accept their recommendations. It has since transpired that there are three hundred cars laid by for want of motormen, and that the Council's drivers are still being called up to the forces. In an effort to fill some of the vacancies the over-age conductors are being encouraged to become drivers. Scotland Yard has again laid itself open to criticism. For a long time the police prevented Metropolitan tramways authorities from following the example of provincial undertakings and employing women as conductors. It has now transpired at Bermondsey Tribunal that they refused to license as a motorman a conductor aged 39, married, passed for general serivce, who had been trained to drive with the object of replacing a younger man. The military representative said the Council asked for some consideration in cases like this, as they were releasing single men drivers for the army as fast as they could. A further two months' exemption was granted. It was stated at the Council's meeting on January 23 that many drivers of slow vehicles deliberately obstructed the tramcars, and that the police failed to carry out the provisions of the regulation, obtained just prior to the war, requiring such vehicles to keep close to the kerb. At Ilford the manager of the Urban Council Tramways has reported that owing to the heavier loads carried, to the number of new motormen, to the terrible darkness of the roads, necessitating an extravagant use of current, during the six months to September 30 the consumption increased by 20 per cent. per car-mile, or £1,092. Ilford tramways department has 29 drivers to do the work done by 43 before the war. Several services have been reduced, including one which was carrying 25,000 munition workers to the railway.

MEXBOROUGH.

PROPOSAL TO ACQUIRE THE TRAMWAYS COMPANY'S UNDERTAKING.

Mexborough Corporation have appointed a sub-committee to consider the desirability of acquiring the undertakng of the Mexborough and Swinton Tramways Company.

MIDDLESBROUGH.

SUGGESTED PURCHASE OF THE DISTRICT TRAMWAYS.

The Middlesbrough and other local authorities have appointed a committee to consider the question whether they shall in 1919 exercise the option of purchasing the undertaking of the Middlesbrough, Stockton and Thornaby Tramways Company.

NEWCASTLE-ON-TYNE.

" LAST CAR " SLOGAN—BOY SCOUTS ASSIST CONDUCTORS—THE FRONT EXIT CARS—WOMAN CONDUCTOR REWARDED.

" Please do not wait for the last car " is an appeal made to passengers in the cars of Newcastle Corporation Tramways. Last car times now range from 9.45 to 10.9, the restriction having been made in order to lessen the strain entailed on the car employees by the darkened streets and to enable their strength to be concentrated on the vast workmen's traffic along the banks of the Tyne. Another interesting innovation on the Corporation Tramways appears to be proving satisfactory. A number of boy scouts assist the women conductors at night by watching the trolley, calling out the stopping places, and ringing the bell. The boys enjoy the work, and their assistance has lightened the duties of the women. Gosforth Urban Council have decided to complain to the Board of Trade of " the inconvenience caused by the new type of car, in which passengers have to enter at the rear and leave at the front end ; and that this class of car is really dangerous on account of the insufficient accommodation on the leaving platform, and that the position of the steps and their insufficient size is such that passengers who are getting out run the risk of being knocked down by passing traffic." A similar complaint forwarded to Newcastle Corporation brought a reply from the town clerk that experience did not bear out the contention that the new type was dangerous. At a meeting of the Tramways Committee on January 25, Councillor R. Mayne, the chairman, on behalf of the committee, presented two guineas to Mrs. Barras, a conductor, who was recently responsible for the arrest of three pickpockets in one of the cars. The chairman commended

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to the notice of other women who had undertaken responsible duties in the tramway service the quickness and promptitude of action displayed by the recipient.

SOUTHEND-ON-SEA.

Double Deck Cars on Narrow Gauge.

Owing to the difficulty of obtaining cars, Mr. R. Birkett, general manager and electrical engineer, Southend Corporation Tramways, has proposed that several of the cars should be fitted with an upper deck. The Board of Trade has suggested that as the gauge of the tramways is only 3 ft. 6 in., the bogie cars should first be dealt with. The Tramways Committee have asked Mr. Birkett to make inquiries as to the experience of other undertakings with double-deck cars on the narrow gauge.

SHEFFIELD.

Track Renewals Deferred—Life of Rails Lengthened by Welding.

The total cost of repairs and renewals of Sheffield tramways permanent way for the year ended March 25, 1916, amounted to £26,041, a decrease of £9,945. In his report for the year, Mr. W. J. Hadfield, the city surveyor, who is responsible for the work, says that the reduction of expenditure was enforced owing to prevailing conditions. Repairs have been made in many cases in which, in ordinary times, renewals would have been carried out. The only capital expenditure was £14, which compares with £5,705 for the previous year. Welding has been a great help in dealing with old tracks which could not be renewed. Usually the joints wear out first, and the welding process has provided a practicable method of lengthening the life of track which otherwise must have been relaid. The total number of joints welded on March 25 was 6,876.

QUEUE LOADING.

Bradford's Compulsory Regulation.

First prosecutions of tramway passengers recently took place at Bradford under the regulations recently approved by the Board of Trade, at the instance of the Watch Committee, for securing the formation of queues by persons intending to travel by tramcar. Two men were summoned for not entering a car in the order in which they were entitled in Tyrrel Street. In one case a police constable said the defendant entered the car out of his turn when fifty people were waiting in the queue. When spoken to he said, "There is nobody going inside, and you cannot stop me." In defence the accused said that as no one was entering the lower saloon he went inside. The stipendiary magistrate, in dismissing the summons with a caution, said that as there was no one entering the lower portion of the car there may have been some reason for defendant thinking he could enter the car. He advised defendant to take his proper turn in the future. In the other case the constable and a tramway inspector said there was a rush for the car, and they endeavoured to get the people to take their turn. The majority did so, but defendant said that he was going on the car. The magistrate dismissed the summons, but said he wished it to be understood that passengers should assist the authorities to keep the regulations. If it were not for such regulations it would be impossible for passengers to board the cars in the proper manner.

Separate Loading Places at Halifax.

In order to meet the increased traffic due to war work, and to atone for the lack of central loading facilities due to Halifax not possessing a large central open space, Mr. J. D. Caird, traffic manager of the Corporation Tramways, has introduced an improved method for enabling passengers to board the cars in comfort. The scheme will be adopted gradually, in order to get passengers thoroughly accustomed to it. Its main feature is the use of different places for the formation of queues to the cars which start from one terminus but run to different destinations. No handrail is used, and intending passengers are called upon to form two deep, the left-hand side for inside passengers and the right-hand for the top saloon. The sites for the queues are indicated by notice boards, "Stand here for cars to ——," whatever place the person wishes to travel. The system, it is hoped, will not only do away with the crushing due to passengers alighting and mounting the cars at one and the same place, but will prevent short distance fares crowding out long distance passengers.

Metropolitan Association of Electric Tramway Managers.—A meeting of the members of this Association was held at the Municipal and County Club, Whitehall Court, Whitehall, S.W., on January 19, when various matters of interest were discussed. Those present included Messrs. W. C. Ullmann (East Ham), chairman, W. E. Hammond (M.E.T.), vice-chairman, J. K. Bruce (L.C.C.), F. Schofield (Leyton), L. E. Harvey (Ilford), L. Slattery (West Ham), A. V. Mason (South Met.), T. B. Mackinnon (London United), and T. B. Goodyer (Croydon), honorary secretary. Letters of inability to attend were received from Messrs. Stokes (Bexley Heath), Williams (Erith), and Murray (Walthamstow).

CALENDARS AND BOOKLETS.

Charles Churchill and Company, Limited, issue a useful calendar (15 in. by 11 in.). The tear-off pages for each month are mounted on strong cardboard bearing an attractive design in blue and fawn.

The Electric Construction Company, Limited, have sent to their friends with their good wishes for the New Year a convenient little diary handsomely bound in red leather, the cover having separate compartments for stamps, cards, etc.

The British Aluminium Company's calendar for 1917 (10½ in. by 8 in.) presents a striking illustration of the dam at Kinlochleven, and on the reverse is printed a roll of honour of the staff and employees of the company who answered the call of their King and country. The names of the men who have fallen are specially indicated, and the list shows how generously the company have responded to the nation's need.

British Berna Motor Lorries, Limited, have issued an attractive calendar (18¾ in. by 12 in.), with a tear-off sheet for each month. Each sheet bears an excellent reproduction of a photograph of some commercial vehicle of the company's manufacture. The monthly calendar, which occupies the lower half of each page, is clearly printed, and at the bottom is given the lighting-up time for each month.

The London General Omnibus Company have issued a handsome little calendar (9½ in. by 7 in.) consisting of six stiff cardboard sheets, each containing the calendar for two months and a photograph of war scenes of more than usual interest. There is, for instance, a photograph of the M.E.T. omnibus in a Flanders village, British troops waiting to embark on the motor omnibuses, scenes during the great exodus from Ostend, etc.

Alfred Herbert, Limited, of Coventry, have published their usual calendar for 1917 (14 in. by 6½ in.). Each of the twelve pages is handsomely printed in colours on glazed paper, each page containing an interesting illustration of tools of the company's manufacture, or of interiors at the company's works. The pictures have all been recently taken, many of them showing women engaged in the various branches of machine shop work. The last page contains a complete calendar for the year.

Clayton and Company (Huddersfield), Limited, manufacturers of the "Karrier" commercial motor vehicles, have sent to us a day-to-day calendar (10½ in. by 8 in.) for the current year. The calendar is mounted on a card which represents the front of a "Karrier" motor, the condenser end being shown with an aluminium finish with the word "Karrier" printed at the top in relief on a red background. The daily calendar block is placed in the centre below a calendar for the year. The combination of the day-to-day calendar with that for the twelve months is convenient, and will be much appreciated by recipients.

Thermit, Limited, have sent to us a copy of their pocket memorandum book and calendar for 1917. It is conveniently arranged so that the pages when filled may be taken out of the cover and a refill inserted. Much interesting information with reference to Thermit welding is contained in the pocket-book, and in the introduction the company takes the opportunity of reminding their customers that the shares of the company have passed into the hands of the Birmingham Metal and Munitions Company, Limited, of Birmingham, who are a subsidiary company of Nobel's Explosives Company, Limited, Glasgow. The whole of the company's office and working staffs are now exclusively British, and the manufacture of their well-known products is being carried on at their works, 675, Commercial Road, London, E., their sole address. In the coming year they hope to open up new fields of action of a metallurgical character.

FOR HIGH-CLASS
CONDENSING PLANT
WRITE TO
THE MIRRLEES WATSON CO., LTD.,
SCOTLAND STREET, GLASGOW.

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PATENT LIST.

Abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

*** If the inventions have been communicated the names of the communicators are given below in italics.

APPLICATIONS FOR LETTERS PATENT.

Rail joints (116)—A. E. Alexander (*Interlocking Rail Joint Corporation*).
Electric signalling systems (306)—F. G. Bell and W. C. Davey.
Brake mechanism for railway and tramway rolling stock (110)—Birmingham Railway Carriage and Wagon Company and H. H. Holloway.
Front-driven motor vehicles (9)—A. W. Brightmore.
Electric cables (18)—British Insulated and Helsby Cables and J. Brotherton.
Direction indicators for vehicles (281)—J. Cleland.
Car wheels (29)—V. J. Conces.
Signalling device for motor vehicles (289)—F. H. Hesselbein.
Bodies of motor road vehicles (199)—S. G. Jacobs.
Metal vehicle wheels (256, 257 and 258)—T. E. Murray.
Automatic electric control of petrol electric vehicles (38 and 1095)—V. S. Robinson and P. F. Smith.
Apparatus for heat treatment of tramway and railway rails *in situ* (145)—C. P. Sandberg.
Motor vehicles (96)—L. Crawshay-Williams.
Devices for damping oscillations of suspension springs of motor vehicles (518)—L. Dufour.
Internal-combustion engines for motor vehicles (541)—H. E. Freakley.
Motor lorry wheels (433)—G. H. Robinson.
Brake apparatus (385)—W. H. Rymer.
Apparatus for laying railways (868)—G. R. Hughes.
Friction clutches and brake mechanism (1,010)—A. G. Langdon.
Light or portable railways and rolling stock (809)—F. C. J. E. Peeters.

STEAM AND HYDRAULIC
ENGINE PACKING
MANUFACTURERS
(Flax, Asbestos and Cotton)
And all Engine Room Stores
ATTWATER & SONS
Hopwood Street Mills, PRESTON
Telegraphic Address: "Attwaters, Preston."

Means for securing rails to sleepers (849)—M. E. Rees.
Differential gear for motor vehicles (786)—H. O. W. Vincent.
Petrol-engine bearings (1,263)—G. E. Bradshaw.
Motor vehicle lighting dynamos (1,155)—C. L. Breeden and H. Lucas.
Motor road vehicles (1,066)—W. H. Brown and G. F. Joseph.
Railways (1,141)—R. Buet.
Automatic change-speed gearing for motor vehicles (1,078)—A. N. Chenoweth.
Traffic clearance gauge (1,054)—W. H. Fisher.
Motor vehicles (1,134)—C. W. Fulton.
Non-skid devices for motor vehicles (1,173)—G. Gunther and W. P. Miller.
Electric signalling systems (1,233)—R. Lambourne.
Method for guiding groove of trolley wheels of tramcars on to electric wire (1,113)—T. Main.
Wheels of motor vehicles (1,281)—J. Marshall.
Bodies of motor vehicles (1,262)—T. Norton.
Automatic stopping device for locomotives and railway rolling stock (1,101)—J. B. S. Poyser.
Change-speed gears for motor vehicles (1,302)—G. E. Stanley and Triumph Cycle Company.

SPECIFICATIONS PUBLISHED.

1915.

Lifeguard for tramway car (18,158)—Glennie.
Mono-rail systems (17,652)—English.
Automatic train-stopping devices (17,923)—Lyttle and Costello.
Motor vehicle wheels (18,170)—James and Milford.

1916.

In the following list the numbers in italics are those that the specifications will finally bear and under which they will be indexed and abridged before acceptance and finally printed. The application numbers should, however, still be used for correspondence purposes.
Construction of the bodies of motor vehicles (1,734—*102,537*)—S. G. Jacobs.
Driving gear for motor vehicles (2,222—*102,542*)—F. H. Mingay.
Train-stopping apparatus (5,238—*102,667*)—A. X. W. Grondin.
Brake control of trains (14,340—*101,873*)—C. H. Woodward.
Bogies for railway vehicles (12—*102,742*)—A. Spencer.
Railway vehicle controlling systems (7,040—*102,787*)—W. B. Murray.
Lifting jacks (12,345—*102,803*)—H. J. C. Forrester (*G. B. Hurlburt, A. F. Lanier* and *J. H. Joynes*).
Cross-overs for mono-rail systems (17,781—*102,811*).—P. English.
Control mechanism for preventing excessive speed of motor vehicles (226—*102,820*)—R. A. Duncan.
Electrical driving, particularly for motor vehicles (4,962—*102,864*)—H. Crochat.
Starting handle for petrol and spirit motors which will prevent all accidents caused by the "back-firing" of the engine (6,465—*102,873*)—W. Gannon.
Air-brake systems (6,818—*102,877*)—National Safety Appliance Co.
Automatic train-stopping devices (11,859—*102,904*)—A. L. Lyttle and C. I. Costello.

Colonial and Foreign Tramways Traffic Returns.

NAME OF COMPANY.	1916. WEEKS ENDED. Jan. 8.	Jan. 15.	Jan. 22.	Jan. 29.		1917. WEEKS ENDED. Jan. 6.	Jan. 13.	Jan. 20.	Jan. 27.		AGGREGATE. Wks.	1917.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Anglo-Argentine	50,841	50,239	47,515	47,476	...	51,929	51,246	46,818	48,956	...	4	198,949	+ 2,878
Calcutta ... ... Rs.	60,013	70,287	68,717	66,514	...	66,160	74,428	73,210	68,641	...	4	282,439	+ 16,908
Hong Kong ... ... $	...	...	...	...	...	...	...	...	...	...	-	-	-
Madras ... ... Rs.	...	...	...	...	...	...	...	...	...	...	-	-	-

Companies Issuing Monthly Statements.

	1915. Aug.	Sept.	Oct.	Nov.	Dec.	1916. Jan.	Aug.	Sept.	1916. Oct.	Nov.	Dec.	1917. Jan.	Wks.	AGGREGATE. 1916 17.	+ or - .
	£	£	£	£	£	£	£	£	£	£	£	£		£	£
Ballarat & Bendigo ...	2,860	3,075	3,401	3,586	3,396	...	2,791	2 850	3,390	3,429	3,089	...	36	28.628	+ 136
Brazilian Traction Mlrs	6576000	6494000	6793000	6336000	...	...	7184000	6920000	7037000	6943000	...	...	48	75,229,000	+4,642,890
Brisbane	35,064	30,360	31,880	31,120	...	...	37,900	32,530	32,760	26,740	...	...	48	357,160	+ 10,086
British Columbia	$507,126	517.022	538,826	562,782	...	...	550,293	540,440	573,544	604,576	...	...	22	2.807.146	+ 170,667
Buenos Ayres Lacroze	41,468	39,355	43,516	46,033	43,528	...	36,431	37,075	39,670	42,603	40,106	...	26	230,895	- 20.036
Burma	25,159	22,163	25,531	23.695	22,185	...	24,412	23,749	29,768	26,824	30,250	...	22	135,003	+ 16.270
Cape Town	...	...	...	...	...	...	13.394	...	14.238	...	...	...	—	—	—
Carthagena & Herrerias	1,523	1,252	2,169	2,090	2,129	2.841	2,081	1,779	2.539	2 252	2,399	3.982	4	3,982	+ 1,141
Cordoba	14,159	13,210	13,441	...	...	...	13,852	13,389	13,533	...	...	...	31	98,087	+ 740
East India	2,266	2.054	2.069	2,065	2,062	2.015	2,522	2,523	2,080	1,942	2,120	1.836	26	13,023	- 492
Kalgoorlie	3,165	2.997	2,675	...	...	...	3,021	2,788	2,716	...	...	...	44	25,983	- 1.808
La Plata	4,164	3.894	4,405	4.564	4 563	4.533	3,792	3,994	4,435	4.342	4,436	4 315	4	4,315	- 218
Lima	32.004	30.530	32,211	30,720	35,110	...	33,395	33,348	33,292	33,625	35,845	...	52	406.820	+ 20,498
Manaos ... Rs.	...	...	...	...	...	...	147,774	141,286	...	142.858	...	...	—	—	—
Manila	...	...	...	...	...	...	33,700	...	...	...	...	...	31	887,739	+ 39,986
Mexico ... $	...	...	...	...	...	...	...	...	...	...	...	...	—	—	—
Monte Video	26,494	25,070	27,167	28.407	31,305	34,252	26,044	26,711	...	28,404	31,364	33.341	13	93,109	- 855
Peruvian ...	$819,039	755.280	806,900	751,720	823.600	862.100	895,900	911,910	945.590	925,820	990.842	935.130	30	6.440.622	+ 897,145
Port Elizabeth	...	...	...	...	...	...	2,863	...	3,131	...	...	...	—	—	—
Rangoon	4,510	4,445	4,886	5,028	4,492	...	4,253	4.137	5.043	5,033	4.904	...	52	56,308	- 1,427
Toronto ...	$762,627	804,902	792,001	851,113	...	...	889,241	913,535	907,460	911,829	...	...	48	9,825,053	+ 1.031,334
Winnipeg ...	$251,189	261,982	286,146	323,025	...	...	249,795	267,497	278,817	282.899	...	...	48	3,023.170	- 99,450

(*Continued on page 106*)

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TRAFFIC RETURNS—*continued.*

Tramways and Omnibus Undertakings in the United Kingdom.

NAME OF COMPANY OR CORPORATION.	1916. WEEKS ENDED.					1917. WEEKS ENDED.					AGGREGATE.		
	Jan. 8.	Jan. 15.	Jan. 22.	Jan. 29.	—	Jan. 6.	Jan. 13.	Jan. 20.	Jan. 27.	—	Wks.	1917.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Aberdare U.D. Council	368	368	356	374	...	408	378	374	365	...	43	17.001	+ 1,706
Aberdeen Corporation	2,152	1,804	1,677	1,662	...	2,237	1,835	1,789	1,719	...	34	65,429	+ 3,689
Accrington Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
Ayr Corporation	305	244	257	256	...	321	257	253	246	...	37	15,375	+ 1,253
Bath Electric	*	...	...	...	...	...	...	...	...	...	—	—	—
Birkenhead Corporation	1,458	1,408	1,414	1,407	...	1,570	1,483	1,455	1,394	...	43½	66,633	+ 6,311
Birmingham Corporation	16,032	15,564	15,705	15,616	...	16,448	15,633	16,013	15,425	...	43	684,602	+ 55,180
Birmingham Corp. Motor Omnibuses	824	790	815	803	...	958	848	888	833	...	43	42,395	+ 5,719
Blackburn Corporation	1,200	1,116	1,076	1,093	...	1,206	1,096	1,053	1,029	...	43½	53,892	— 1,090
Blackpool and Fleetwood	380	312	292	294	...	406	299	275	237	...	4	1,227	— 129
Blackpool Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
Bolton Corporation	3,050	2,600	2,665	...	...	3,281	2,761	2,735	...	...	—	—	—
Bournemouth Corporation	1,997	1,880	1,910	1,876	...	1,926	1,834	1,670	1,627	...	44	99,477	+ 6,060
Bradford Corporation	6,258	6,189	6,345	6,261	...	6,769	6,466	5,966	5,939	...	43	292,269	+ 9,995
Brighton Corporation	940	874	896	913	...	1,113	969	911	880	...	43½	54,218	+ 5,695
Bristol	4,695	4,671	4,609	4,629	...	4,945	4,576	4,498	4,256	...	43	16,975	— 1,629
Burnley Corporation	1,699	1,689	1,569	1,608	...	1,704	1,624	1,475	1,476	...	44	74,363	+ 3,301
Burton-on-Trent Corporation	316	282	286	264	...	292	280	282	264	...	43	12,065	— 658
Bury Corporation	1,354	1,274	1,278	1,267	...	1,508	1,280	1,293	1,214	...	43½	61,507	+ 2,441
Cardiff Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
Chatham and District	919	1,038	1,075	1,136	...	652	1,072	1,065	1,021	...	4	3,810	— 359
Chesterfield Corporation	271	261	262	249	...	260	233	239	230	...	43	11,780	+ 67
Colne Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
Cork Electric	414	470	462	446	...	279	463	421	430	...	4	1,593	— 199
Croydon Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
Derby Corporation	1,098	1,021	1,060	1,027	...	1,065	1,006	997	965	...	43½	48,516	+ 2,557
Dover Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
Dublin and Lucan	114	113	112	118	...	84	125	117	107	...	4	432	— 26
Dublin United	...	6,040	6,018	5,919	...	...	6,169	5,875	5,779	...	4	22,588	+ 106
Dundee City	1,704	1,293	1,304	1,281	...	1,652	1,308	1,289	1,267	...	36½	50,722	+ 978
East Ham Corporation	1,324	1,321	1,293	1,269	...	1,226	1,182	1,174	1,141	...	43½	55,594	— 1,217
Exeter Corporation	360	335	338	325	...	399	362	334	304	...	43	17,319	+ 987
Gearless Motor 'Buses	*	...	...	...	...	...	...	...	...	...	—	—	—
Glasgow Corporation	24,252	21,755	21,744	22,296	...	26,419	22,963	22,952	22,731	...	34½	810,812	+ 59,297
Glasgow Subway	1,203	...	...	...	...	1,377	...	...	...	...	—	—	—
Glossop (Urban Elec. Supply Co.)	134	131	132	132	...	137	139	122	121	...	4	521	— 10
Halifax Corporation	1,929	2,039	1,937	1,933	...	2,093	1,959	1,831	1,791	...	42½	93,970	+ 574
Halifax Corp. Motor Omnibuses	46	40	44	40	...	54	48	45	45	...	42½	2,120	+ 30
Hastings and District	825	773	701	756	...	1,055	942	883	832	...	4	3,712	+ 658
Huddersfield Corporation	2,642	2,560	2,620	2,666	...	2,792	2,626	2,537	2,506	...	43	121,402	+ 8,789
Hull Corporation	3,322	3,269	3,219	3,191	...	3,286	3,175	3,402	3,235	...	43	136,213	+ 1,466
Ilford U.D. Council	661	635	629	613	...	619	576	577	556	...	43	29,004	+ 989
Ilkeston Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
Ipswich Corporation	502	475	488	479	...	412	383	377	348	...	43	21,742	— 1,877
Isle of Thanet	268	256	241	254	...	268	216	209	204	...	17	4,354	— 117
Kilmarnock Corporation	199	158	157	160	...	230	157	158	151	...	36½	6,477	+ 216
Lanarkshire	2,448	2,068	2,076	2,049	...	2,167	2,259	2,233	2,282	...	4	8,941	+ 300
Lancashire United	1,833	1,593	1,596	1,633	...	2,104	1,723	1,694	1,691	...	4	6,148	+ 334
Leeds City	9,120	8,896	8,876	9,035	...	9,837	9,306	9,084	9,038	...	44	423,651	+ 35,458
Leicester Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
Leith Corporation	850	759	752	774	...	1,010	866	843	811	...	36½	32,349	+ 3,955
Leyton U.D. Council	1,539	1,516	1,506	1,472	...	1,473	1,471	1,450	1,492	...	43	70 261	+ 355
Liverpool Corporation	14,240	13,672	13,743	13,375	...	14,964	14,331	13,873	13,480	...	3½	55.377	+ 1,552
Llandudno and Colwyn Bay	178	187	195	198	...	218	183	179	160	...	8½	1.562	— 12
London County Council	45,762	45.945	45.342	45.591	...	45.677	46,725	45.002	44,538	...	42½	2.040,723	— 145.715
London General Omnibus	*	...	...	...	...	...	...	...	...	...	—	—	—
London United	*	...	...	...	...	...	...	...	...	...	—	—	—
Lowestoft Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
Maidstone Corporation	215	195	178	181	...	240	196	175	171	...	43	9,326	— 106
Manchester Corporation	18,333	17.576	17,898	17,743	...	18,835	18,195	17.916	17,631	...	41	808.943	+ 37,919
Metropolitan Electric Tramways	*	...	...	...	...	...	...	...	...	...	—	—	—
National Steam Car	*	...	...	...	...	...	...	...	...	...	—	—	—
Nelson Corporation	191	182	200	202	...	...	193	184	188	...	43½	9,144	+ 619
Newcastle-on-Tyne Corporation	5,930	5,823	5,868	5,983	...	6,547	6,546	6,643	6,711	...	43	290.540	+ 21.790
Newport (Mon.) Corporation	898	862	876	845	...	1,066	955	907	863	...	43	41.637	+ 4.753
New St. Helens and District	992	919	911	906	...	1,119	986	960	946	...	30	33.278	+ 2,402
Northampton Corporation	716	681	701	695	...	789	721	689	663	...	43	31,077	— 434
Nottingham Corporation	3,713	3,747	3,735	3,740	...	3,782	3,774	3,692	3,613	...	43	167,627	+ 6,009
Oldham Corporation	2,343	2,290	2,309	2,318	...	2,409	2,199	2,192	2,081	...	44	107,100	+ 4,847
Portsmouth Corporation	2,339	2,239	2,175	2,133	...	2,479	2,141	2,053	1,827	...	—	—	—
Preston Corporation	1,052	1,050	1,004	1,000	...	1,154	1,080	1,049	1,052	...	42½	47,694	+ 5,522
Provincial	2.167	2,144	2.066	2,061	...	2,136	1,933	1,880	1,750	...	17	34,136	+ 972
Reading Corporation	750	783	769	751	...	877	851	850	773	...	43½	37,137	+ 2,947
Rhondda Tramways	671	1,188	1,214	1.211	...	793	1,285	1,317	1.260	...	4	4.656	+ 371
Rochdale Corporation	1,704	1,614	1,659	1,699	...	1,722	1,547	1,481	1,483	...	43½	76,117	+ 1,822
Rotherham Corporation	1,259	1,272	1,258	1,224	...	1,596	1,573	1.601	1,577	...	43½	68,490	+ 16,599
Salford Corporation	5,241	5,154	5,222	5,181	...	5,487	5,209	5.165	5,029	...	42½	235,236	+ 8,641
Sheffield Corporation	9,737	9.667	9,687	9,712	...	10.899	10,444	10,558	10,559	...	44½	466,321	+ 66,728
Southampton Corporation	1,527	1,508	1,441	1,459	...	1,675	1,606	1,548	1,487	...	42½	71,683	+ 6.612
Southend-on-Sea Corporation	608	607	591	601	...	674	623	594	585	...	43	39,235	+ 3,198
South Metropolitan Tramways	*	...	...	...	...	...	...	...	...	...	—	—	—
South Shields Corporation	805	740	732	756	...	860	810	792	791	...	43½	36.466	+ 2,105
Sunderland Corporation	1.610	1,482	1,470	1,526	...	1,712	1,571	1,550	1,558	...	43	71,556	+ 5,432
Sunderland District	...	...	544	603	...	...	...	576	636	...	13	8,211	+ 813
Swindon Corporation	204	...	...	...	...	216	...	...	...	...	—	—	—
Torquay Tramways	236	478	430	416	...	349	491	484	412	...	4	1.737	+ 176
Tramways (M.E.T.) Omnibus Co.	*	...	...	...	...	...	...	...	...	...	—	—	—
Tyneside Tramways and Tramroads	531	497	498	509	...	631	586	577	589	...	4	2.032	+ 161
Wallasey Corporation	1,231	1,088	1,163	1 132	...	1,299	1,203	1.151	1,108	...	43½	58,840	+ 3,262
Walsall Corporation	804	824	815	;834	...	820	727	543	701	...	4	2,703	— 731
Walthamstow U.D. Council	783	752	765	781	...	991	946	907	879	...	43	46.664	+ 8,129
Warrington Corporation	511	492	486	468	...	551	507	497	479	...	43	21,581	+ 1.655
West Ham Corporation	3.028	2,989	2.986	3 009	...	3.085	2.977	2.940	3,121	...	42½	137,469	+ 4,443
Wigan Corporation	1.693	1,573	1,485	...	...	1,886	1,628	1,604	...	...	—	—	—
Wolverhampton Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
Yorkshire (West Riding)	1,697	1,521	1,595	1,641	...	1,835	1,741	1,726	1,744	...	4	7,046	+ 591

* TRAFFIC RETURNS SUSPENDED.

Owing to the European war, the Government have taken over the railways of Great Britain as from August 4, 1914, and the issue of traffic returns has been suspended. Consequently the traffic returns of the electric railways which usually appear on this page cannot be given.

The Publication of the Traffic Returns of the Tramways marked with an asterisk in the above table have also been suspended during the war.

TRAMWAY DIRECTORIES.

A useful feature of this issue is the directory of electric railways and electric tramways which will be found among the advertising pages. This directory contains the names of the chief officials and the principal particulars relating to each undertaking.

THE TRAMWAY AND RAILWAY WORLD

can be obtained, post free, at the following rates:

For the United Kingdom—
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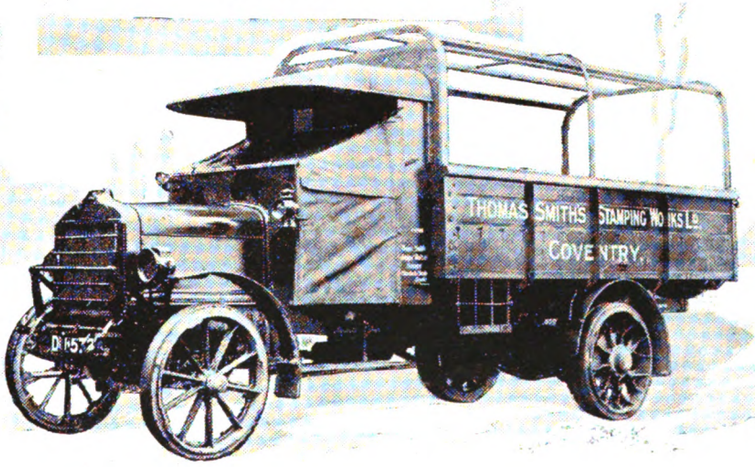
Solely engaged on National & Imperial Service

BEFORE THE WAR the Daimler Commercial chassis was a pronounced favouri.e amongst Commercial users. It was the accepted standard of all the leading Corporations, Carrying Companies and Commercial Houses.

DURING THE WAR, under the most trying and unforeseen conditions, its reputation has been still further enhanced; the Daimler Sleeve-valve engine proving its superiority in reliability and endurance over all other types.

AFTER THE WAR orders will be executed in rotation. Prospective users are invited to make their enquiries and investigations early.

The Daimler Company Ltd.
COVENTRY



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MOTOR VEHICLES.

TWO MODELS

To Carry 30/45 cwt. & 3½ tons Respectively

"The Design and Construction are Throughout of a Character, which it would be Exceedingly Difficult, if not Impossible, to Improve Upon."

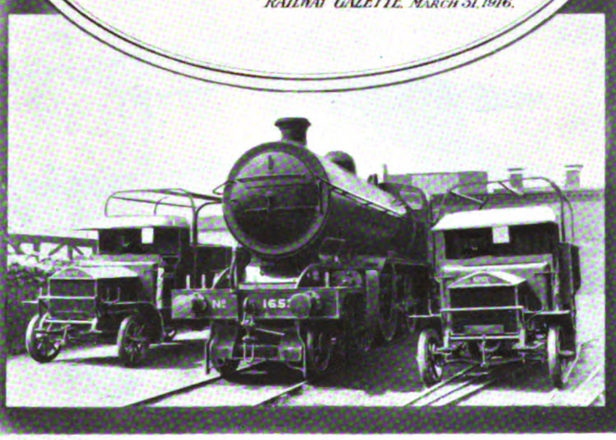
RAILWAY GAZETTE, March 31, 1916.

IN PEACE

USED BY THE LARGEST CARRYING COMPANIES AND COMMERCIAL HOUSES.

IN WAR

USED BY THE BRITISH AND ALLIED GOVERNMENTS.



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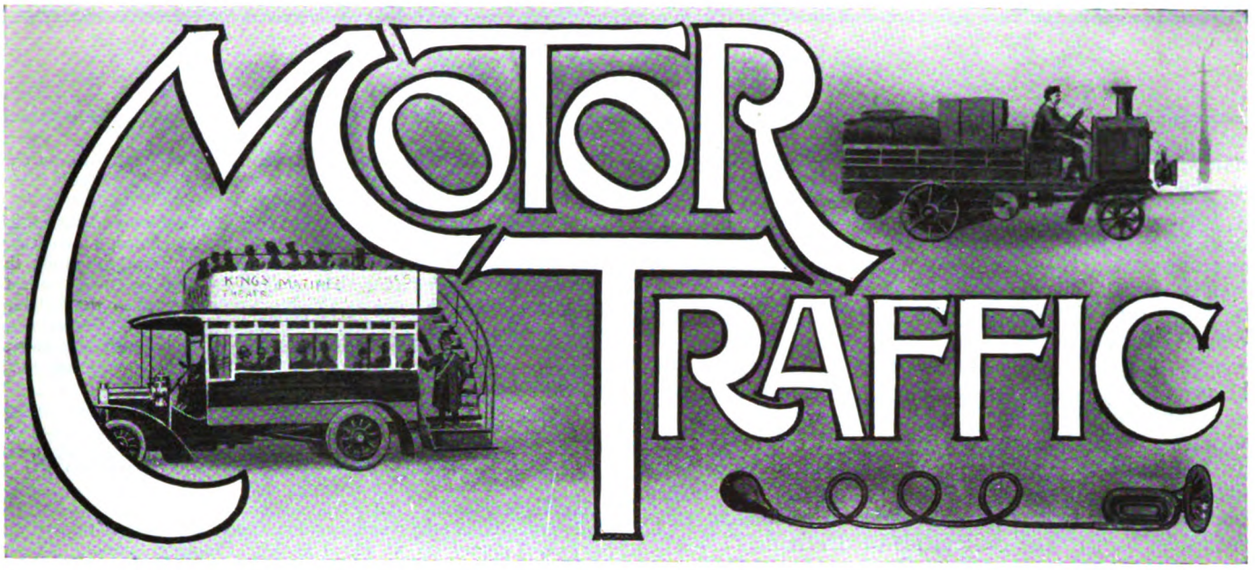

The question of traffic safety is by no means a war problem, although the war has given it increased urgency and seriousness. Nor is it purely a question of motor traffic. The introduction of mechanical propulsion has been followed, it is true, by a large increase in the number of cases of deaths and injuries in the streets, but horsed vans and cycles account for a formidable proportion of these casualties—this directly, and more important is their indirect effect. The main cause of accidents in streets is not speed, but congestion of traffic, and congestion is most frequent and most severe in those parts of London and other great cities where the local and industrial conditions are such as to make for a more than average proportion of heavy and therefore slow-moving horsed vans. It is the presence of such localities all round the "square mile" that in theory constitutes the City of London that gives rise to its well-known difficulties, and these, of course, are intensely aggravated by narrow streets. But it has been pointed out in repeated Board of Trade annual reports that the narrowness of the streets is by no means the determining cause. A thoroughfare of restricted width offers comparatively little obstruction to traffic passing quickly through and uniform in speed. When, however, the traffic is mixed, there at once ensues a slowing down to an average which is certainly never above, and often is appreciably below, the maximum speed of the slowest-moving units. Thus arise the conditions which not only do a great deal to neutralise the advantages of employing motor tranport by restricting its speed considerably within the somewhat artificial legal limits, involving consequently a great aggregate waste of time and money, but contribute the most powerfully to making the passage of the streets dangerous to pedestrians. One may express it shortly by saying "the more horses the more accidents," and in present urban conditions it is literally true. The safest streets in London are those where the proportion of motor vehicles to the whole of those passing through is the highest, and the most dangerous are those in which horsed vans figure most prominently.

* * * * * *

Committees and Commissions have already sat to consider the question of London traffic, but they have not arrived at any very satisfactory conclusions, and many of the recommendations of the Royal Commission which issued its report well over ten years ago, have been proved unfortunate by events. The scope of the House of Commons inquiry of 1913 was somewhat narrow, and its deliberations were too obviously influenced by the omnibus *versus* tramway issue, for its results to have had real practical value. Consequently, before the question of street traffic in London—and the big provincial towns—can be finally and fully dealt with, the whole subject will probably have to be considered afresh, and in the light of the significant experience gained in the last four years. One important, if at first sight revolutionary, suggestion presents itself—that of imposing a legal *minimum* as well as a *maximum* speed for city traffic. The effect of this would be to restrict the use of the streets by the heavier and slower class of traffic to certain hours of the day. It would, of course, provide a very powerful inducement to those who have not yet adopted mechanical transport to inquire into its possibilities, but it is to be doubted if it would inflict any real hardship upon anyone. Seven years ago, perhaps, such a proposition would have been premature; it would have been too sweeping even three years ago. But to-day we know that there is no need for railless transport that cannot be met by self-propelled vehicles of one form or another—steam, petrol, or electric—and perhaps it is the successful development of the "electric" in recent times that now enables this to be said. As a matter of cold fact, and not as a statement arising out of any partisan enthusiasm, the horse in city traffic is an unnecessary survival, and it is merely a question of expediency as to whether it might not be worth while to hasten its departure by legislative means. By so doing much would be gained from every point of view.

* * * * * *

Of course this is essentially a matter for "after the war," but with all its preoccupations we cannot afford entirely to ignore internal questions of this kind. Had the policy of sitting still been adopted, the death-roll in London streets would have been even larger than has unhappily been the case. The formation of a "Safety First" Council, comprising representatives of omnibus and tramway undertakings and of municipal and other authorities was, no doubt, due primarily to the great increase in the numbers of accidents following upon the darkening of the streets, but its usefulness is obviously permanent and continuous, and it certainly provides a nucleus, if not more than a nucleus, for the traffic authority for the Metropolis, the demand for which has arisen since motor traffic became considerable. It is, of

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MOTOR TRAFFIC.

course, a logical extension of the measures taken by the London General Omnibus Company within its own organisation, in which everything is done to impress upon the employees and the public the paramount need of safety. That these efforts have already borne excellent fruit is evident in the fact that, in spite of many adverse conditions, there has been a decrease of accidents in which motor omnibuses were involved of 20 per cent. in 1916 as compared with the previous year. But again it must be insisted that in a large proportion of accidents for which motor vehicles are held accountable the real origin is some slower-moving vehicle. It is the traffic of this latter category that introduces the element of uncertainty and confusion that is so dangerous to pedestrians, and adds, too, to the difficulties of driving.

It is peculiarly unfortunate, after assurances that we had learnt the worst as regards petrol supplies, that we are now told that further restrictions must be considered as highly probable. Of course this may be due to recently changed conditions in connection with sea transport, and unexpectedly large demands on behalf of the fighting services, but it is rather suspiciously typical of the proceedings of the Petrol Control Committee throughout its career. Government departments and authorities have issued contradictory announcements before to-day, and as a rule this sort of thing does not very much matter. But motor transport is not a national plaything, and petrol (except in price) is not a luxury, but a first necessity. The restrictions have caused widespread and serious inconvenience, a result which could not have been avoided no matter how wisely they had been administered. And wisdom, and due consideration for the issues involved, have not unduly characterised the committee's activities. Motor-users require no gratuitous demonstrations of the fact that "there is a war on," and equally with everybody else will cheerfully submit to any inconveniences that may be inevitable. They do not care to feel, however, that they are being made the victim of official irresponsibility, and to make or to authorise announcements of a contradictory character within brief spaces of time savours very much of that quality.

INSTITUTION OF AUTOMOBILE ENGINEERS.

A meeting of the London Graduates of the Institution of Automobile Engineers was held on January 25, when Mr. P. A. Williams read a paper entitled "Some Calculations in Automobile Engine Design," Mr. L. H. Pomeroy being in the chair.

The first point dealt with was that of compression, in which the author, referring to some tests by Dr. Watson (Proceedings, I.A.E.), pointed out that the compression curve lay somewhere between the isothermal and the adiabatic curves, showing that some heat during compression was lost to the cylinder walls, giving an exponent lower than the adiabatic exponent for a perfect gas, viz., 1·4.

From these curves 1·29 was found to be the value, making the law $PV^{1·29}$ = constant. Taking this law, the expression to find the volume of combustion chamber was deduced. Some simple calculations on bearing pressures on gudgeon pin and big end bearings were next taken, it being thought that this was the safer method of dealing with the problem.

The question of cams was dealt with at some length, and they were classified as follows:—(*a*) Tangent cam; (*b*) constant acceleration cam; (*c*) harmonic cam.

In the cases of the constant acceleration and harmonic cams the maximum acceleration was obtained both by graphical differentiation and mathematically. From the acceleration the necessary spring force was obtained and the size of spring found. It was interesting to note that the spring required for the harmonic cam at the particular speed taken was approximately a gauge heavier than that for the constant acceleration cam.

The paper concluded with a treatment of helical gears, from which the formula was obtained for centre distance, it being shown that, given a certain velocity ratio, helix angle and diametral pitch, the centre distance was fixed. The general method in design was to work to a centre distance as nearly as possible, given the velocity ratio and diametral pitch, and so find the helix angle. Rather than solve the equation to find the angle, it was better to work out several values and plot the relation between centre distances and helix angles, and so find the angle required.

POPULARISING PASSENGER TRANSPORTATION.

The ninth Operating Department Efficiency Meeting of the London Underground Railways and London General Omnibus Group was held on January 26 at the L.G.O.C. Training School, Chelsea, Mr. H. E. Blain, the operating manager, presiding over an attendance reaching nearly 200. A paper on the "Popularising of Passenger Transportation" was read by Mr. S. T. Trigg, the chief inspector of the Tube Railways, who divided his subject into two main parts—(*a*) attracting the passenger, and (*b*) getting and keeping the passenger.

The importance of the various forms of advertising media, posters, press, house-to-house distribution, etc., was pointed out, and an interesting collection of posters was exhibited round the walls, the specimens including some of the most attractive issued by the various railway companies, and incidentally showing the extent to which the artistic side of publicity was studied. As an instance of the value of special publicity campaigns, the recent scheme of the G.E. Railway encouraging the poultry and egg trade in the provinces was referred to, and the "Safety First" and other campaigns were commended. The necessity for publicity for country routes, seaside excursions, etc., was emphasised, and the American notion of amusement parks discussed. Slides were shown indicating the great improvement of recent years in the station sign schemes, and in the display of station advertisements.

In the second part of the paper, the importance of frequent service, regular and punctual running, prompt attention to booking offices, lifts and ticket barriers on the railways, and on the front and back of tramcars and omnibuses, was pointed out, and special emphasis laid on the display of tact and courtesy on the part of the staff. In the latter connection, various systems of staff reward and punishment were referred to. Brightness, neatness, and reasonable ornamentation of stations added effect, and the changes of the past few years in this respect were also shown by slides. Points in connection with rolling stock were discussed as well as the central control system in connection with the regulation of headways, etc., this system having now been successfully adopted in connection with both the Underground railways and the Omnibus Company.

The final portion of the paper dealt with adjuncts to travel, in the shape of lifts, escalators, etc., and referred also to fare systems.

A discussion was opened by Mr. E. S. Welton, indoor assistant of the general superintendent (L.G.O.C.), and was continued by a large number of speakers, several interesting and valuable suggestions being made.

BIRMINGHAM MUNICIPAL OMNIBUSES.

In connection with the difficulties encountered in carrying on the Birmingham Corporation Tramways during the war, it may be observed that the trials of both the public and the department would have been greatly increased but for the fact that the Tramways Committee possess a fleet of thirty motor omnibuses. Of these the majority are used for the conveyance of munition workers, while the remainder continue their work of providing for localities where no tramways exist. Eighteen other motor omnibuses were in operation before the war, but these have been impressed by the military. A further handicap has been the restriction of the petrol supply, and the quantity now available has to be eked out by making a mixture of 20 per cent. of paraffin to 80 per cent. of petrol.

Motor Fire Vehicles at Glasgow.—The plant and appliances of the Glasgow Corporation Fire Brigade include 27 motor vehicles, of which 18 are petrol pumps and five are hose wagons. The latest motor installation comprises four motor vehicles at a new station just erected for the southern district.

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MOTOR TRAFFIC.

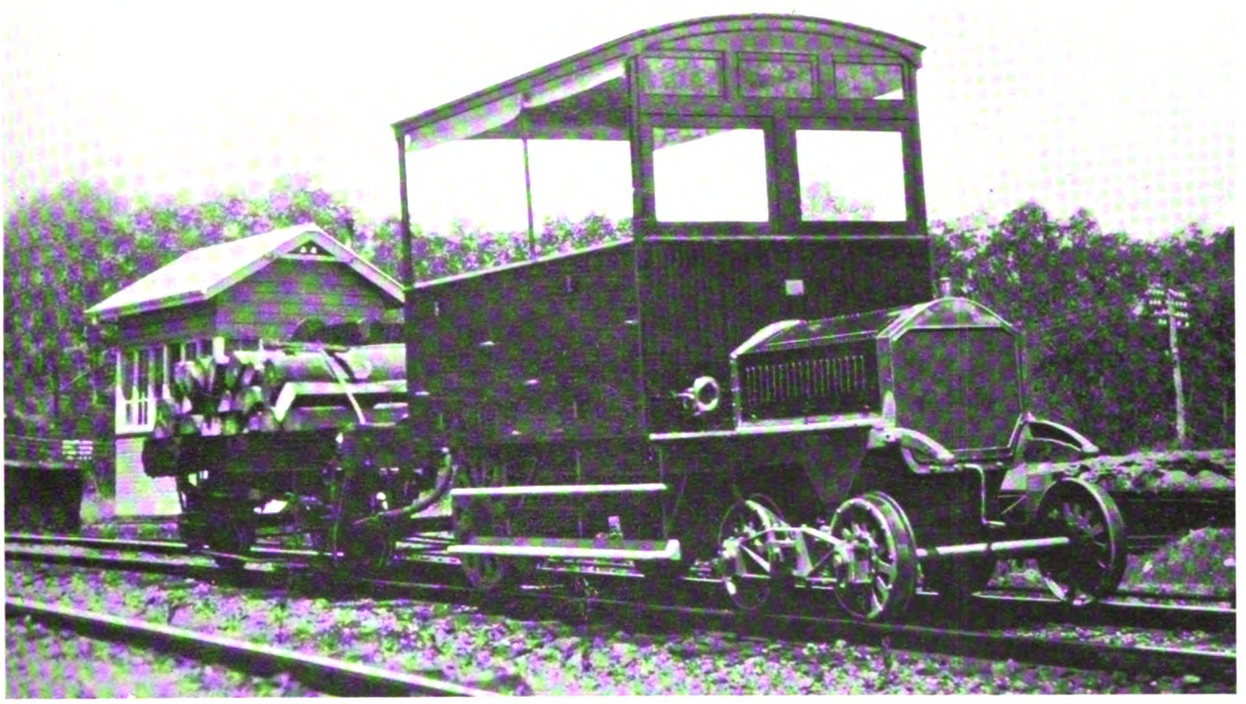
ROAD MOTOR ON A RAILWAY.

SUCCESSFUL ADAPTATION OF A 45-H.P. NAPIER CHASSIS.

The subjoined photograph shows a Napier car transformed into a railway motor. The chassis is that of a 45-H.P. car which was supplied to the Queensland Railway Commissioner some four years ago by Town and Country Amalgamated Motors, Limited, of Brisbane, and it had completed considerably over 100,000 miles, comprising mainly long country tours, and had twice negotiated the country surrounding the Gulf of Carpentaria.

In conversation with Commissioner Evans, of the Railway Department, the idea was conceived to make an experiment with this car, and to convert it into a railway motor for conveying passengers and haulage on the Cooktown to Laura Railway. The work of alteration was carried out at the Ipswich railway workshops, and in October last the first test was held in conjunction with the officials of the Railway Department.

The car left Ipswich *en route* for Laidley. At Grandchester a hopper wagon underframe was attached, loaded with sleepers,



45-h.p. Napier Converted into a Railway Motor.

and the Little Liverpool range was negotiated with comparative ease at a speed of 20 miles per hour. Although the car left 15 min. late, she arrived at Laidley on time, and during the return journey the speed of 37 miles was maintained. The riding of the car was very steady, and the Commissioner expressed his delight with the success of the scheme. He further agreed that there was scope on the Queensland railways for a large number of such cars.

The Little Liverpool range has an incline of 1 in 25 on a 4-chain curve. The load consisted of a truck of railway sleepers, and a van containing ten passengers It was found unnecessary to use lower than second gear, and the petrol consumption worked out at slightly over 30 miles to the gallon.

The most remarkable feature of this test car is that the back axle is intact, and was merely shortened up to take the gauge.

In bringing the trial to the attention of D. Napier and Son, Limited, 14, New Burlington Street, London, W., Mr. F. J. Holland, the sales manager of Town and Country Motors, Limited, writes :—" Perhaps we in Australia appreciate more than you the quality of the material used in the construction of these cars, knowing the conditions under which this car has been used, and finding no appreciable trace of wear in either the crown or pinion to warrant any replacement. The Napier certainly justifies its claim that it has a right to make its home in Queensland as being one of the highest products in engineering. We here are dependent upon home productions in this kind of engineering. We would like to mention at this stage the precarious position in which we have been placed for the reason that the local motor world is well aware of this first and wonderful test made by us with the 45-H.P. Napier, and owing to the impossibility of securing your goods at the present time there is a great danger that American agents will bid for this trade, which would be extremely disappointing in view of our having held fast to Allies' manufacture only, among which we place the Napier first always."

AMERICAN MOTOR OMNIBUSES.

The number of motor omnibuses recently constructed at the Philadelphia works of the J. G. Brill Company clearly indicate the growing importance of the omnibus as a means of transport in American cities and suburban districts. Among the Brill vehicles completed within the past few months are two types quite different in design, and intended for different methods of operation. The first was constructed for the Interborough 'Bus Company, of River Edge, New Jersey. It has a wheel base of 13 ft. 6 in. Entrance and exit is by the rear platform, and the driver is enclosed in a cab on the forward left-hand side of the body. The second vehicle, made for another company, has a wheel base of 12 ft. Entrance and exit is made through double folding doors on the forward right-hand side, slightly to the rear of the driver's seat, enabling the 'bus to be operated by one man, to whom prepayment is made by passengers as they enter.

The omnibus for the Interborough Company has a plain arched roof, and the window sashes are double, the upper raising and the lower dropping into sockets. A single sliding door is located in the rear bulkhead. The interior is handsomely finished in ash, with maple veneer ceiling. The seats are of Brill twill-woven rattan, those placed transversely having stationary backs. The driver's cab is entered through a door on the left-hand side, and is equipped with a comfortable leather seat. Push buttons are provided on the side posts. Yellow pine and oak are used in the underframe construction, while poplar and ash are used in the upper framing.

The North Stamford and Long Ridge Road Auto-'Bus Company, by whom the second vehicle was purchased, has a service over a distance of about nine miles. The omnibus is for use on the regular route, where it affords transport mainly to school children of the

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MOTOR TRAFFIC.

rural district. Oak is used throughout in the underframe construction, side sills being 2¾ in. by 2¾ in., and the end sills 2¾ in. by 3 in. The upper framing is entirely of ash, having 3¼ in. corner posts and 1½ in. side posts. The sashes on both sides are of the two-part type, the upper being stationary and the lower arranged to raise. The windows in the front are the same; the one directly in front of the driver is provided with a shield, which prevents his vision being obscured in stormy weather. The door opening on the right-hand side is 2 ft. 6 in. wide, and is provided with a two-leaf folding door operated by the motorman in conjunction with the lower section of the double step. A single emergency door is located in the centre of the rear, and is equipped with a mechanism which may be operated by passengers. The interior is finished in cherry, and the ceiling is veneered. The seats are of Brill twill-woven rattan, stationary backs, and a section of the back seat is removable in case of an emergency.

AUSTIN LORRIES.

War Service Improvements in 2-3 Ton Vehicles.

The Austin Company, Longbridge Works, Northfield, near Birmingham, whose vehicles have done such excellent service on all the battle fronts during the past two and a half years, announce that the Ministry of Munitions are now permitting them to supply a limited number of 2-3 ton lorries to firms employing motor transport, most of whom may be regarded as engaged on work of national importance.

In ordinary times a home-built vehicle is to be preferred to any other; in these critical times the purchase of a British make is a national duty. Apart from international complications arising out of the adjustment of imports and exports, apart from all sentimental considerations, and deciding solely on the certainty of receiving value for money, there can be no more lucrative or lasting investment than an Austin lorry, which can be fitted with a body to serve any purpose, from a simple van to a pantechnicon or passenger omnibus. It is as modern as a war-inspired, war-speeded factory can make it; engine and component parts are as new as the paint applied to it.

There is no need to wait for after-war speculations, reflections and designs. All the reflecting, speculating, designing have been done on the scenes of action. Thinkers and producers have finished their tasks. The product waits to be surveyed and proved by the sceptical who may not know the worth of the Austin bond. This lorry, decorated for meritorious service through the convincing and comforting proofs afforded by renewed contracts, is now at the service of others, capable of doing still better work in the pathways of peace. Buyers will be supplied according to date order, and the price of the chassis so long as purchase is possible—a time limit being applied to the selling period—is £695.

Our columns have often contained references to the indispensable aid that motor vehicles have given in the conduct of the war, but for good reasons it has not been possible hitherto to refer in detail to improvements that individual manufacturers have effected in their machines as the result of war experience. The veil can now be lifted in the case of the Austin Company. Profiting by their unique experience—severe preliminary trials at home, watched by engineering experts from the capitals of Europe, followed by over two years' strenuous activity in war zones, constantly in and out of the fighting lines (again under the scrutiny of the best engineers serving with the mechanical transport service)—the Austin management have practically tracked almost every wheel, investigated every trouble, and found a remedy for every weakness revealed in lorry service. It would have been foolish to have done otherwise; even the best to-day can be bettered to-morrow in a conflict that is proving the greatest reliability trial that motor transport has ever undergone.

As the outcome of all this testing and of actual service in conditions known alone to the officers, engineers, and drivers, between 30 and 40 detail improvements have been incorporated. A summary of a few is appended, and, for the guidance of those interested, it may be stated that a complete specification will be supplied from Longbridge Works, Northfield, Birmingham, or on application at any of the company's depots:—

In the engine, which has four separate cylinders, with stems and springs enclosed by detachable covers, the main bearing bolts are carried right through from the top of the crank case.

Travelling Kitchens and Workshops for War Service at the Austin Company's Motor Works.

Petrol is fed by the Auto-Vac system, and the capacity of the tank increased to 30 gallons.

A flexible pipe connects the oil tank and engine for lubricating purposes; the oil tank itself is easily accessible for cleaning or replenishing.

Friction surface of the clutch has been increased to 3 in. in width.

Nickel-chrome has largely superseded mild case-hardened steel. For example, all gears are now made of this material, and the wheel spindle of the front axle, besides being increased in diameter, is machined direct from nickel-chrome steel bar, instead of from a flanged forging, thus avoiding internal radius and forging strains.

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MOTOR TRAFFIC.

Semi-elliptic springs fitted to the rear wheels, one mounted above and the other below the axle, transmit the driving and braking effort without undue strain on the main leaves, neither radius rods nor torque tubes being required.

Rear spring front bracket is widened to take driving strains, and a stronger front spring front bracket fitted.

The countershaft brake—a cast-iron drum of moderate size—has Ferodo lining on the external shoes. A smaller brake drum prevents overstraining of transmission. To keep water out of the bearing, a felt ring is fitted against the hand brake lever on axle.

"Roads" Traversed by War-built Vehicles of The Austin Company.

Renewable case-hardened sleeves on which the road wheels run are a new feature of the rear axle. Bearings are lubricated with oil instead of grease.

In designing the frame one of the aims was to obtain a low loading line, and the lattice girder principle ensures exceptional rigidity. Finally, reference may be made to accessibility—an important factor that has been considered from every point of view with, it is believed, useful results, all parts that require adjustment, lubrication, etc., being get-at-able without trouble.

On this and the adjoining page will be seen illustrations of workshops and kitchens that the Austin Company have supplied to the British armies and to those of our Allies. Every pattern of vehicle is supplied—cars for Staff purposes, lorries for the transport of men and munitions, armoured vehicles for attack or defence, travelling workshops, kitchens, ambulances, etc., and other patterns for specific uses.

No British firm has studied more closely or more successfully the problems of motor transport than the Austin Company, particularly those related to war service, and none has produced more reliable or more adaptable vehicles for the risky adventures involved in a prolonged campaign. From its birth the Austin Company has enjoyed the highest reputation for building pleasure cars; it enhanced this reputation when the commercial vehicle became a national necessity, and it has reached the top pinnacle in its war output. Quantity presents few difficulties at the Northfield Works. Extension has followed extension, workers have been increased thousand after thousand, and in all other spheres there have been developments in keeping with the growth of factories and the massing of armies of employees.

Motor Car for Rotherham Tramways Department.—The Corporation have decided to purchase a motor car for the use of the Tramways and Electricity Department.

ROADS FOR MOTOR TRAFFIC.

Wandsworth Borough Council, who have already spent many thousands of pounds on the reconstruction of roads with wooden blocks on a 9-in. concrete foundation, in order to render them fit for motor omnibus and other heavy traffic, contemplate an extension of such activity after the war. The Council have informed the Local Government Board, in response to their inquiry as to the works they propose to carry out, that they have resolved to include wood paving and other schemes approved by the Road Board, for which the preliminary approximate estimate is £23,717, wood paving renewals estimated approximately at £64,815, and wood paving schemes necessitated by new omnibus routes estimated to cost approximately £33,288.

Use of Tar-Macadam at Sheffield.

Mr. W. J. Hadfield, city and permanent way engineer of Sheffield, in his yearly report states that the expenditure on road schemes, approved by the Road Board, up to March 25 last, amounted to £28,371, and it is now possible in some measure to realise what the financial effect of this work will be. During the four years which have passed since reconstruction was commenced, £7,224 has been saved on maintenance charges—about 55 per cent. of the previous cost of maintaining the roads in question—and this was during the period of conversion, when some of the roads still had to be maintained in the old way. The report adds: "This is a very moderate way of putting it, as in the meantime motor traffic (for which the roads originally were not fitted) has increased, and maintenance costs must have gone up rapidly had the old form of construction remained. Experience in Sheffield shows that, by substituting tar-macadam for water-bound, not only do the public get far superior roads, free from mud in winter and comparatively free from dust in summer, but also that, although such roads are subject to an increasing amount of motor traffic, including some omnibus traffic, the latter being a new factor, they are cheaper to maintain than were the same roads under horse traffic when made in the old way."

Reference is made to the Redmire and Sandygate motor omnibus route, run in connection with Sheffield Corporation tramways in order to show the difference in traffic and its effect on road surfaces. A grant was obtained from the Road Board in the year 1913 for the purpose of constructing a tar-macadam centre along both roads, from Manchester Road to Lodge Moor Hospital, in order to withstand the omnibus traffic. Between February, 1913, and March, 1916, in which months traffic returns were taken, the daily weight of traffic passing over these roads (the average effective width of

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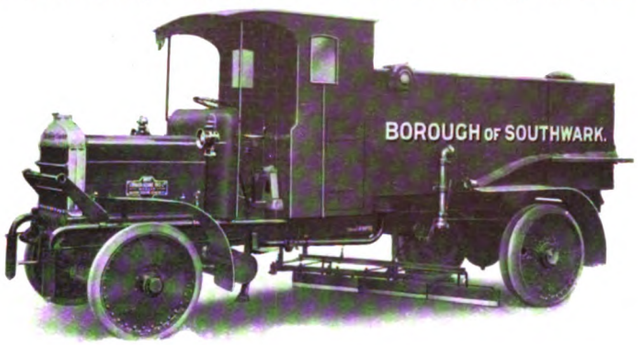
MOTOR TRAFFIC.

which is about 7 yds.), calculated on the Road Board basis, had increased rom 414 tons to 958 tons. The increase i due entirely to heavy motor traffic (horse traffic, in fact, having diminished about 33 per cent), while ordinary motor cars have remained at about the old figure Even without the omnibuses, motor traffic over this route would still exceed the total weight of all traffic when the previous census was taken A though the tar-macadam strip gene.a ly has remained in good condition, the sides have suffered severely, and this was beginning to affect the tar-macadam. The worst parts of the margins have now been dealt with, and further sums are being included in the estimates from time to time for dealing with the remainder in the same way.

STRAKER-SQUIRE STREET-WASHING MACHINE.

Photographs are published on this page in illustration of the street washing machine manufactured by Straker-Squire, Limited, Nelson Square, Blackfriars, S.E. A stream of water under pressure, directed on to the road surface, serves to remove the dirt, while a rubber squeegee following the stream, and carried by the same



"Straker" High Pressure Street Sweeper.

machine as that conveying the water and jets, is used to dry the surface afterwards. The complete outfit is the result of the combined efforts of Straker-Squire (1913), Limited, and Mr. Arthur Harrison, the borough engineer of Southwark.

It is mounted on a 5-ton Straker-Squire chassis, the only departure from standard being the inclusion of worm and wheel final transmission with a ratio of 1 to 10 instead of 1 to 8. Between the engine and gear box is a supplementary gear, from which, by silent chain, a drive is taken to a twin-stage centrifugal pump, placed on a level with the driver's seat and just behind it. This pump draws water from a 1,100-gallon tank situated where the body is usually placed, and delivers it to nozzles in front of the chassis at a pressure which may vary from 40 lbs. to 60 lbs. per square inch. These nozzles, of which there are two, direct fan-shaped streams of water vertically on to the ground, the plane of the fan to any angle to the direction in which the machine is moving being adjustable from the driver's seat. Behind the seat and below the chassis is a rubber squeegee held in an iron frame built in three sections and swinging on links, so that it can adjust itself to the inequalities of the road. The weight of the framework itself is found sufficient to hold the rubber in contact, and means are provided for lifting the squeegee clear of the road when it is not required.

The machine is suitable for granite, asphalte, and wood paving, but it is necessary that the granite joints are composed of either mastic or cement and not of sand. The machine illustrated above is now in the service of the borough of Southwark, and a second one has been placed on order by the Council.

German Prisoners to Drive Farm Tractors.—In connection with the scheme of the new President of the Board of Agriculture to use German prisoners of war and interned aliens for work on farms, a number of the men are being trained to drive motor ploughs and tractors.

Railless Trolley Cars and Road Wear.—The surveyor of Wharfedale Rural Council estimates that it will cost over £2,000 to repair the roads used by the Leeds railless trolley cars running between Otley and Guiseley. A committee who had inspected the roads considers that in their present state they are dangerous. The council have appointed a deputation to meet members of the West Riding Highways Board, who are responsible for the repair of roads.

HARROGATE COUNCIL'S ACQUISITION.

A 3-ton Daimler of General Utility.

Under a permit of the War Office, the Daimler Company, Limited, of Coventry, have lately supplied Harrogate Corporation with a 3-ton chassis which is capable of being used for the many and varied purposes of municipal work. It is fitted with a tipping frame, and interchangeable lorry and tank bodies, as shown in the illustrations on page 113. The tipping frame is fitted with hand-tipping gear, by means of which an angle of 40 deg. may be developed. The frame-sided lorry body has sides and tailboards that are made to lower, or, alternatively, detached, so that the vehicle can be used with a plain platform body. To facilitate the removal of the lorry body when the vehicle is required for street watering, lifting hooks are fitted at each corner of the body.

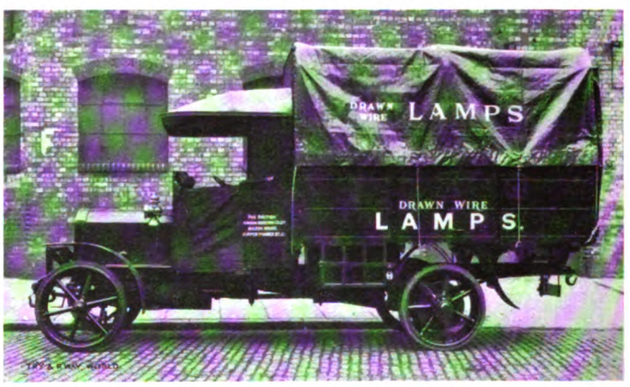
The water tank, built of mild steel, has an approximate capacity of 650 gallons, and is fitted with an improved type of springs. It is mounted on an underframe of English oak. An ingenious use can be made of the tipping gear when the vehicle is engaged in street watering. By means of a handle on each side of the chassis the tank can be adjusted to any angle up to the full limit of the tipping gear. This feature is the subject of one of the illustrations, and its effect is to render the sprinkling apparatus fully effective on gradients.

Messrs. Wadsworth and Sons, of Halifax, were the manufacturers of the tank and of the improved springs upon which it rests, while Messrs. Lockwood and Clarkson, of Leeds, made the tipping frame and the lorry body. With horses and labour rendered scarce by the war, this general utility vehicle is proving of great service.

INADEQUATE RAILWAY SERVICE.

Napier Wagon to Overcome the Deficiency.

Like many firms who are busy on urgent Government requirements, the British Thomson-Houston Company, Limited, have been met by difficulties in railway transport. Recently the company were inquiring for a vehicle that would assist them in providing efficient transit by road. Their choice fell on a 30-45 cwt. Napier business vehicle, which has all the improvements suggested by the long experience of the war. The products of the Napier works at Acton are still being taken by the War Office and other departments,



but this vehicle became available for the British Thomson-Houston Company under the regulation affecting firms occupied with Government work. A photograph of the machine is given herewith, and the British Thomson-Houston Company are to be congratulated upon securing a wagon that will to a great extent relieve them from railway transport worries.

Qualifications for an Omnibus Depot Foreman.—In December last the Oxford Tramways Company obtained exemption for a night foreman, aged 23, until January 31, or till a substitute was found, whichever was earlier. Mr. A. A. Tyler, the manager, said the company were prepared to pay a qualified substitute £3 per week. The military had sent four men, none of whom had the slightest knowledge of repairs, and could only drive an ordinary car. The substitute must be an expert in magnetos and carburettors, have a thorough working knowledge of heavy motors, and be able to drive and test omnibuses. The Tribunal exempted a driver as long as he remains in his present occupation. This man was trained after he had thrice been rejected by the army.

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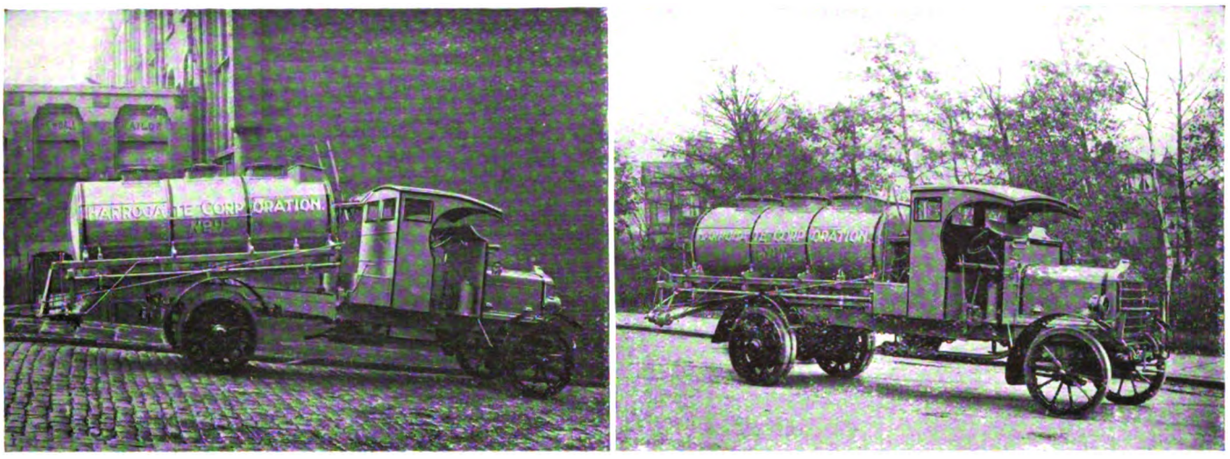
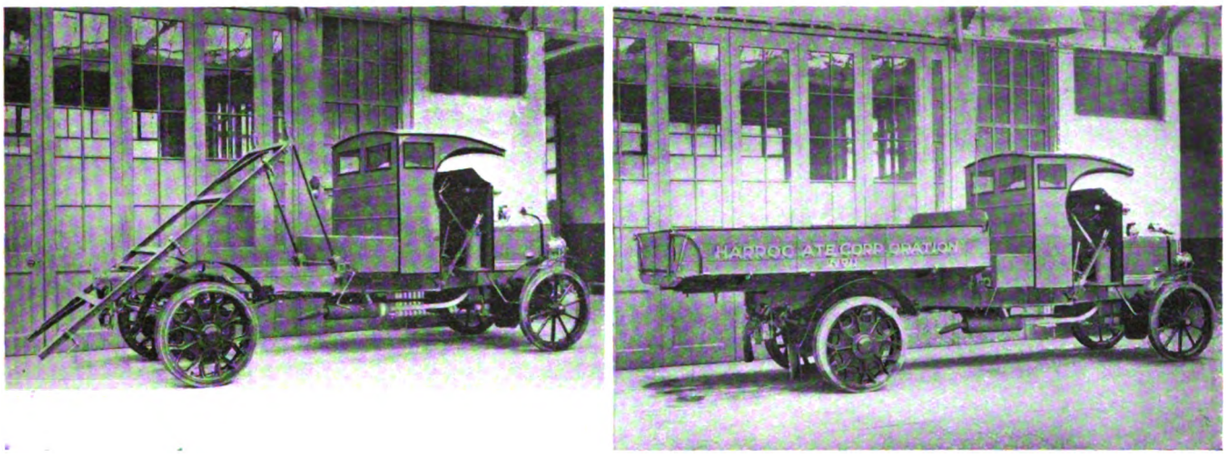
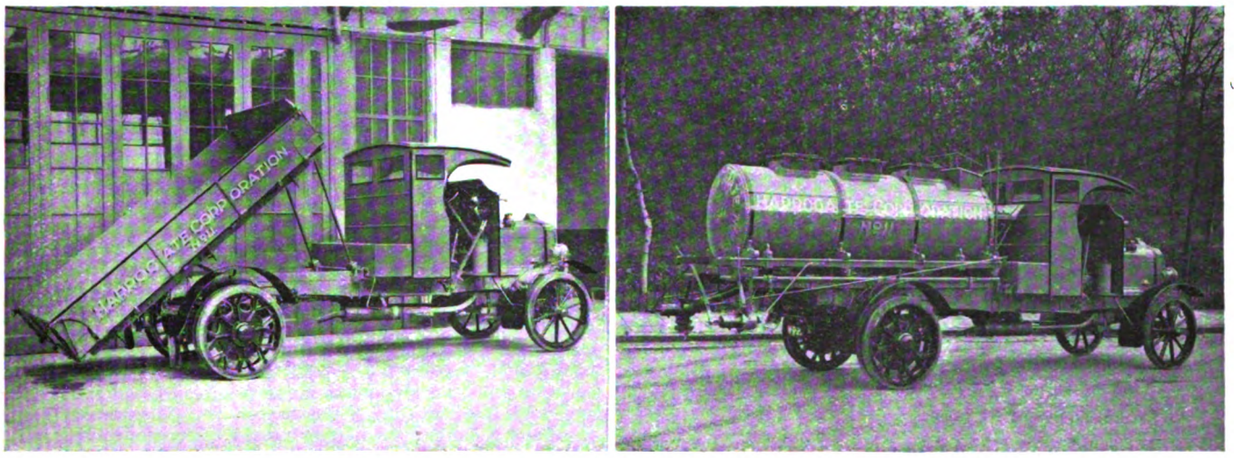
MOTOR TRAFFIC.

THE PETROL MOTOR IN MUNICIPAL SERVICE.







Harrogate Council's 3-Ton Daimler Chassis for General Utility, Fitted with Interchangeable Lorry and Tank Bodies.

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MOTOR TRAFFIC.

MOTOR VEHICLES FOR MUNICIPALITIES.

LEYTON COUNCIL have agreed to obtain a 2-ton Edison motor van for the collection of house refuse.

BRIGHTON COUNCIL have decided to purchase two motor vehicles for street watering and general haulage at £2,050.

EAST GRINSTEAD COUNCIL are considering a proposal to convert a steam roller into a traction engine for the haulage of road materials.

HARROGATE COUNCIL have purchased a 3-ton Daimler chassis fitted with a tipping frame and interchangeable lorry and tank bodies.

PORTSMOUTH CORPORATION have placed a contract for supplying two steam motor wagons with Fodens, Limited, of Sandbach. Tenders were received from six manufacturers.

SHEFFIELD HEALTH COMMITTEE have ordered five additional battery vehicles from Edison Accumulators, Limited, for refuse collection. The price of one of the vehicles is to be £1,264 and of the others £1,066.

BARNSLEY CORPORATION having failed to secure sanction for a loan with which to purchase a motor fire engine, have decided, as an emergency measure, to purchase two motor cars for the use of the fire brigade, at a cost not exceeding £500, to be paid out of revenue.

SHEFFIELD ELECTRICITY DEPARTMENT are disposing of a small motor car in order to purchase a more commodious vehicle. The Corporation have agreed to transfer certain petrol lorries to the military authorities provided priority certificates are given for replacements.

SURBITON Urban Council have ordered from Edison Accumulators, Limited, two battery-propelled dust wagons, at £1,025 each. It is estimated that with these vehicles the cost of dust collection at the end of three years will be about £530 per annum less than by the present system, assuming the contract price next year, and in the succeeding years, to be 10 per cent. more than is now charged. The Council will also have purchased the two vehicles outright, and will have a depreciation fund amounting to nearly £600.

MOTOR TRAFFIC NOTES.

STRAKER-SQUIRE (1913), LIMITED, have taken over Portman House Garage, East Sheen, for the period of the war.

THE ROYAL AUTOMOBILE CLUB is being taken over by the Government in order to meet the demands for the constantly expanding war staffs.

OMNIBUS DEPRECIATION.—The general manager of Bournemouth Corporation Tramways has reported that for the future the revenue authorities will make an allowance of 20 per cent. for depreciation of motor omnibuses, instead of 15 per cent. as hitherto.

LIGHT RAILWAY AND MOTOR ROAD ADJOINING.—The Western District Committee of Perthshire County Council are suggesting that Glasgow Corporation should construct a light railway alongside of the Trossachs Road, and that the District Committee should put in a foundation to the road to render it suitable for motor traffic.

LONDON OMNIBUSES IN WAITING AT THE FRONT.—In connection with the successful British operations near Le Transloy on the Kaiser's birthday, one of the correspondents wrote :—" The enemy was taken prisoner in one practically intact parcel, being found sheltering in the dug-outs of a sunken road running south from the village towards Morval. Motor omnibuses were waiting for him, and he was at once run out of danger on schedule time."

ELECTRIC OMNIBUSES AT YORK AND LANCASTER.—During the year ended March 31 the receipts of the electric omnibuses run by the York tramways department totalled £2,009, or 7·48d. per car-mile. The expenditure was £1,361, equal to 5·03d. per car-mile. Two of the three Edison electric omnibuses ordered by Lancaster tramways department have now been running for two months, and have given every satisfaction. Each vehicle seats 22 passengers.

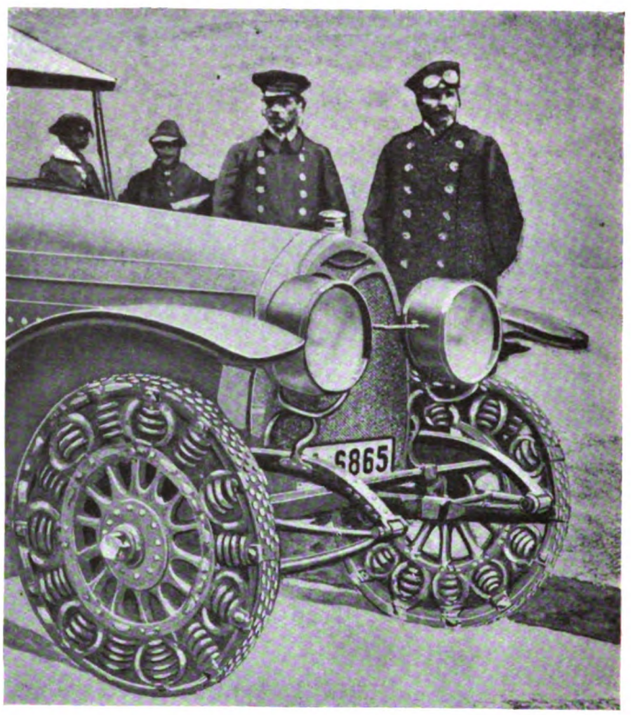
SOLID TIRE MAKERS VISIT THE FRONT.—A number of representatives of British solid tire manufacturers are being sent to France by the War Office to inspect the various transport bases, depots, roads, etc., with a view to their gathering first-hand information as to the performances of the solid tires now in service. It is anticipated that this information will be of considerable value to the industry, and higher efficiency in tire service should be the result.

PETROL REGULATION FOR IRELAND.—The Army Council have issued an order prohibiting the sale of petrol by any but licenced dealers in Ireland, and the supply by those licenced to sell to any persons not in possession of a licence. A record is to be kept on the licences of all petrol sold, and the total is not to exceed the limit specified thereon. The order is on the same lines as that which was promulgated in Great Britain last autumn by the Board of Trade.

SHEFFIELD OMNIBUSES AND ROAD WEAR.—Sheffield Corporation have agreed to a recommendation by the Tramways and Motors Committee that they should engage Mr. H. Humphreys, of London, to inspect and report on the roads on the Stocksbridge omnibus route. Alderman Fenton, deputy chairman of the committee, explained that the committee desired to have an independent report on the state of the road, which was not kept in a satisfactory condition. In case of a dispute with the County Council, it was desirable to have an independent report to confirm that of their own engineer.

TRANSPORT IN THE SOMME ADVANCE.—One of the correspondents, in reviewing the work of transporting the wounded during the clearing of the Somme area of the enemy, says :—" Traffic regulation had also to overcome the most serious obstacles, since railways, roads, and tracks had to provide for the constant reinforcements ; for the frequent passage to and fro of relieving divisions ; for food and water, for men and horses, and also for ammunition unprecedented in quantity. At a rough calculation there were 10,000 horses and mules and 5,000 motor lorries on the road constantly for the artillery service alone."

NEW MOTOR ENGINE ORDER.—The Minister of Munitions on January 8 announced that a permit is necessary for any work connected with the manufacture, assembling, or erection of any new or unused motor internal combustion engine, designed or adapted for mechanical traction, or for any new or unused motor cycle, motor chassis, motor wagon, or of any tractor or other motor vehicles of any kind propelled by mechanical means, except to complete contracts placed by the Admiralty, the War Office, the Minister of Munitions, or an Allied Government on or before November 3, 1916. The new order cancels that published on November 10.



A War Time Substitute for Rubber Tires.

RECOGNITION OF MOTOR VOLUNTEERS.—Under a War Office order of January 14, motor volunteer units have received recognition, and been given a definite status in the home defence force. The Motor Volunteer units in a county will constitute a single volunteer corps, designated the (County) Motor Volunteer Corps—e.g., the County of London Motor Volunteer Corps. The corps will be organised as one or more squadrons, light or heavy. In order to facilitate movement and the execution of repairs, the transport belonging to each squadron will be composed as far as possible of vehicles of similar type, and, if practicable, of the same make. The primary duty of the motor volunteers will be to provide the regimental transport necessary for certain volunteer infantry battalions. It is hoped that these units will also be of definite value in certain other directions.

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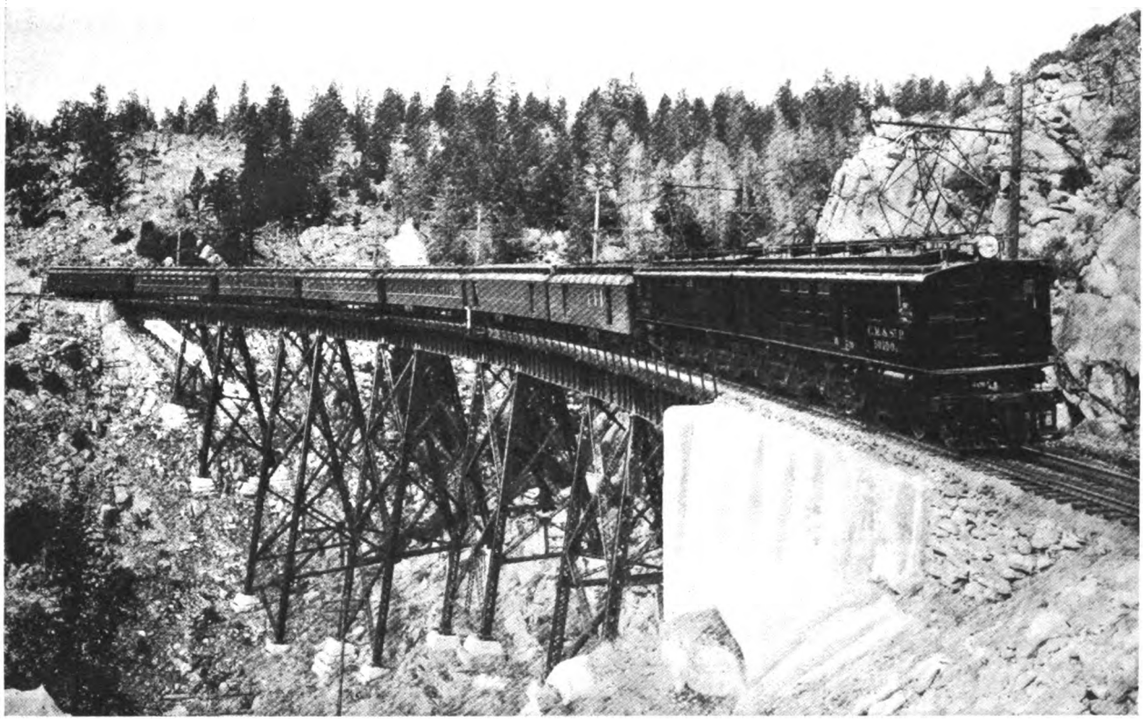
THE Tramway & Railway World
WITH MOTOR TRAFFIC SECTION

Founded 1892. LONDON, MARCH 15, 1917. VOL. XLI.

ELECTRIFICATION OF ST. PAUL RAILWAY OVER THE CASCADE MOUNTAINS.

PRONOUNCED SUCCESS OF COMPANY'S PIONEER WORK.

By far the most important event of the past few weeks in the electric railway field is the decision of the board of directors of the Chicago, Milwaukee and St. Paul Railway to extend their electrified line. The proposed equipment will cover the section of about 250 miles westward from Othello in the State of Washington to the Pacific Coast at Seattle, and thence southward to Tacoma. It is estimated that the work, including the bonding of the rails, catenary and transmission lines, and sub-stations, will cost approximately £1,250,000. The contracts for the material required for the equipment and the electric locomotives will be arranged without delay, as it is proposed that the extension should be ready for operation before the end of next year.



Passenger Train, with Electric Locomotive, Descending Eastern Slope of the Rocky Mountains.

Before referring to the new plans it may be useful to recall the electrification work that has already been carried out by the St. Paul Railway. As will be seen from the accompanying map, the railway extends from the shores of Lake Michigan to the Pacific Ocean, a distance of about 2,200 miles. It is one of those great trans-continental routes that have been such a powerful factor in the rapid development of the United States. The brilliant work of railway engineers in every department, from the task of surveying the routes through wildernesses of mountains and desert to that of designing the steam locomotives required for working over the heavy gradients encountered in the mountain sections, has been of a most remarkable character. When the lines were originally constructed, no one dreamed that it would ever be possible to operate the traffic over these difficult sections by electricity, and even with the development that has been attained in recent years it required no little courage to decide upon the electrification of a section of a line such as that which has now been working with apparently complete success for over a year.

In our issues of February 11 and December 9, 1915,

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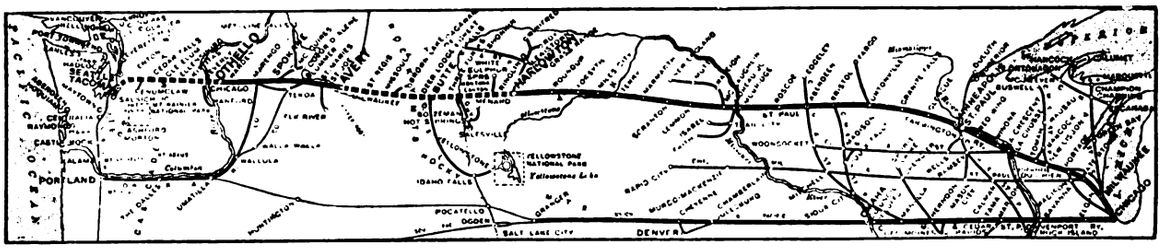
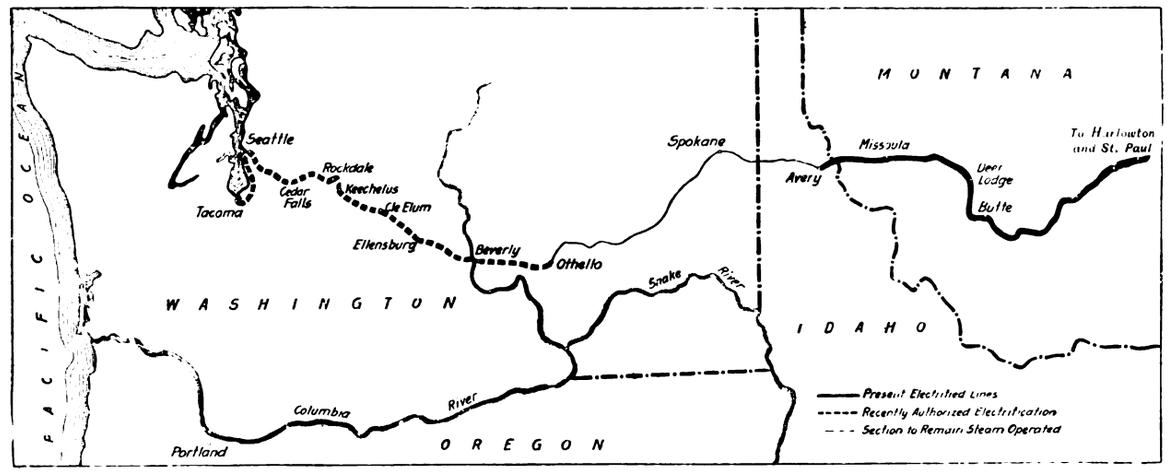
an account was given of the conversion to electric traction of the first mountain section of this railway, and in September of last year we were enabled through the courtesy of the American General Electric Company, the contractors for the complete electrical equipment, to give further particulars. The project of the first electrification was not definitely settled until November, 1914, when the contract was placed for the equipment of the first 113 miles between Three Forks and Deer Lodge, Montana. Subsequently the electrification was extended over the whole 440 miles between Harlowton and Avery. In view of the extent of the work the speed with which it has been carried out is noteworthy.



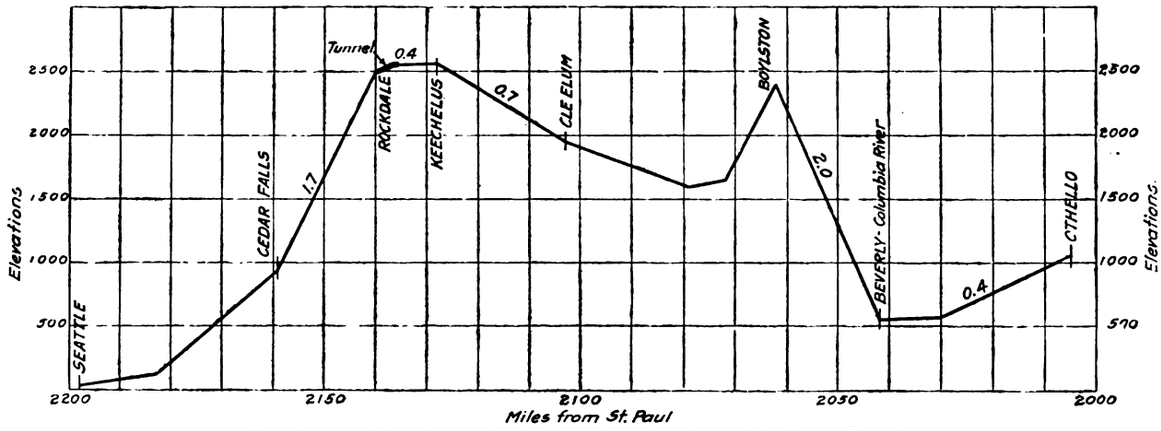
Outline Map of the Chicago, Milwaukee, and St. Paul Railway.
(The Electrified Sections, Present and Authorised, are Indicated by Broken Lines.)

By November, 1915, the overhead construction had been completed for a distance of 115 miles, and the 100,000 volt transmission line erected on the railway company's own right of way had been completed for an equal distance. Seven of the sub-stations designed to supply power for the first half of the 440 miles of road had also been completed and provided with the necessary electrical equipment.

The first complete electric locomotive was tested early in September, 1915, and after being exhibited at various points on its route from Chicago to the electrified division, it hauled on a trial run a train consisting of three special cars conveying officers and directors of the railway and of the American General Electric Company. The test included various speeds up to 70 miles an hour. It was not until January, 1916, however, that steam locomotives entirely ceased working over the division first electrified.



Map of the Railway West of Harlowton, showing the Position of the Present and Authorised Electrical Sections and the Intermediate Steam Section.



Gradients of the Authorised Electrical Section—Othello to Seattle.

In April, 1916, the service was extended to Harlowton, Montana, and by degrees the electrification proceeded until, in February, 1917, the whole of the 440 miles, a distance about equal to that from London to Perth, was electrically operated. In crossing the mountain-

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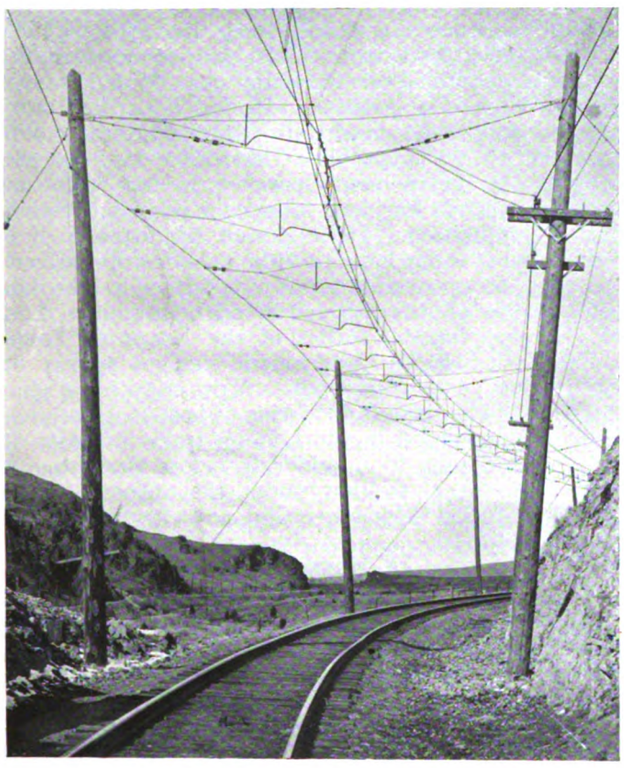
ranges there are several gradients of 1 per cent., the most difficult on the system being that of the 21-mile 2 per cent. gradient between Piedmont and Donald, and the longest the 49-mile 1 per cent. gradient on the west slopes of the Belt Mountains. Energy is supplied from the hydro-electric power station at Great Falls on the Missouri River, through sub-stations, the working pressure being 3,000 volts d.c.

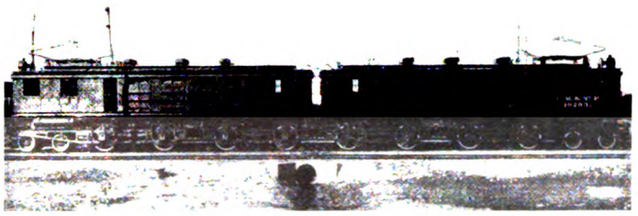
It is not proposed at present to electrify the section between Avery and Othello, for here the railway traverses comparatively level country, characterised by easy gradients and few curves, and the electrification is not regarded as so urgent.

Westward from Othello, as will be seen from the diagram of gradients, the character of the line is much more difficult. There are 37 miles of ·4 per cent. gradient between Othello and Beverly, on the Columbia River, and about 20 miles of 2 per cent. gradient westwards to a point a few miles east of the Cascade Tunnel. Westward of the tunnel the line descends 19 miles on 1·7 per cent. gradient to Cedar Falls, and between Cedar Falls and Seattle, a distance of 40 miles, the gradient is ·8 per cent. Owing to the mountainous country the line includes many sharp curves. The present traffic consists of three passenger trains and an average of from four to six goods trains each way daily, the heavier loads being carried eastward. Under the proposed electric scheme one locomotive will haul about 3,000 tons to Cedar Falls, and an electric pusher will be used for the steep gradient from there to the tunnel. With steam locomotives the speed on the heavy gradients is very low, but it is anticipated that with electric traction it can be doubled. On the completion of the scheme a total distance of about 690 miles will have been electrified.



Typical Catenary Construction on Curve.

The same system of electrification will be used on the new work, as it has been found very satisfactory on the sections already electrified, and the electric locomotives will be practically of the same design as those now in service. Full particulars of the equipment will be found in the earlier articles previously referred to. It may be mentioned that the locomotives weigh 282 tons, and have a running tractive force of 85,000 pounds and a starting tractive force of 136,000 pounds. The passenger locomotives have a gear ratio permitting the running of 800-ton trains at a speed of approximately 60 miles an hour on straight level track. The average passenger train weighs from 650 to 700 tons, and is hauled over the 2 per cent. gradients by the electric locomotives without a helper. The freight locomotives are designed to haul a 2,500-ton train up a 1 per cent. gradient at 16 miles an hour, and two of them have successfully hauled a 3,500-ton train on the 2 per cent. gradient.



Electric Goods Locomotive on the St. Paul Railway.

Mr. C. A. Goodnow, assistant to the president of the railway, who has been in charge of the electrification of the St. Paul, is reported to have declared himself greatly impressed with the satisfactory way in which the locomotives are running and with the ease and speed with which they handle heavy trains over the gradients and curves of the mountain sections. The *Railway Age Gazette*, of New York, remarks that the present electrification has "eliminated the Rocky Mountains as far as railway operation is concerned on the St. Paul."

On the electrical division the schedule for freight and passenger trains has been reduced about one-third, and the electric locomotives are now used to make up time lost on the adjacent steam divisions. It is not the least advantage of the electric locomotives that they deal with the full weight train under all conditions of weather. Their movement is more uniform than that of the steam trains; and the work of handling the traffic on the mountain section has been greatly simplified. The company's officials have intimated that the maintenance cost of the electric locomotives is very satisfactory. As on the previous section, regenerative braking will be used between Othello and Seattle, as explained in our issue of February 8. It is understood that regeneration has effected a saving of approximately 14 per cent., based on the power used on the locomotive.

Energy for the new section will be supplied by hydro-electric power developed in Spokane, Cascade Mountains, and on the Pacific Coast, the power being purchased from private companies. The contracts provide for about 40,000 kilowatts and whatever additional power may be required as the traffic increases. The cost of electric energy will be approximately ·25d. per unit. In contracts made with the Montana Power Company it is provided that the power factor shall be limited to a variation of 20 per cent. from unity, and that the monthly load factor will be equivalent to 60 per cent. when based on the contract load, and it is assumed that the new contracts will contain a similar provision. Such prices are, of course, only possible in districts where water power is abundant and where generating stations on a large scale can be utilised. In the Rocky Mountain district the conditions are entirely favourable.

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LONDON'S TRAFFIC PROBLEM.

The Time for Action.

At first sight the present might be thought an inopportune time for reopening consideration of the great London traffic problem—a subject long debated, to a certain extent dealt with, but still very far from complete solution. A little reflection will, however, show that no better opportunity, at least for preliminary work on the subject, is likely to present itself for years to come. Indeed, it may easily be shown that conditions exist at present which are more than usually hopeful if the matter is taken in hand in earnest.

The conditions referred to are two-fold, one of them general and the other particular. The general condition is that owing to the circumstances arising out of the present war a great proportion of our social, industrial, and commercial arrangements are in the melting pot. The needs of the situation, especially during the last year, have been such that revolutionary changes, which in other times would have been impossible, or only capable of accomplishment after long and acrimonious dispute, have been carried out as by the wave of a magician's wand. It may be said that everything is in a state of flux. And this connotes reform. No reasonable person can suppose that after the war we are going back to old conditions, to hidebound prejudices, to red tape obstruction, to the old party shibboleths. There is a new spirit abroad. It has been demonstrated that under stress of circumstances things can be done which aforetime were regarded as impossible. It is accordingly plain that we are on the eve of great permanent changes. In preparation for the times after the war many of our leading industries are reorganising and drawing up new schemes for their own protection and development. The reconstituted British Government is showing commendable energy in dealing with present and preparing for some future needs.

Many of the activities referred to deal with matters of imperial and national rather than of local concern. But that is no reason why subjects of local concern should not be taken in hand with a view to action as soon as possible after the termination of the war. The spirit of radical reform—not in the party political sense, but in the national, social, and industrial senses—is in the air, and advantage must be taken of it. Besides, a thorough reorganisation of the whole system of traffic, both by road and rail, within the metropolitan area is by no means merely a local concern; it is of national, social, and industrial importance, for the efficient working of the vast London traffic machine is vital to the industries of the whole country and to a certain extent of the Empire. Efficiency, economy, saving of time, and the like, thoroughly carried out in the commercial metropolis of the Empire, must have far-spreading results radiating in every direction. Though here we are mainly concerned with passenger traffic, it is plain that such an organisation as that contemplated would be accompanied by reorganisation of goods traffic on railways in the metropolis and of shipping traffic at the docks.

This indicates the general condition of matters which favours a renewal of efforts for systematising, co-ordinating, and bringing under one general control the whole of the local traffic facilities of London. The other condition—the particular one—is the fact that Sir Albert Stanley has been appointed President of the Board of Trade and in an energetic Government. In the clash of war, in the general activity, in the great national tasks imposed on Government departments, including the Board of Trade, the significance for London of Sir Albert's appointment may in many quarters have escaped notice. But to those who know what the London traffic sphinx-riddle is, what the history of attempts to deal with it is, who Sir Albert Stanley is, and what he has done, the fact that the man who was the organising spirit of the vast passenger-carrying undertakings associated with the Underground Electric Railways Company of London has become President of the Board of Trade in the most energetic British Government of modern times is a matter of special importance. Be it remembered (whatever the detail criticisms may be) that this is a Government which does things and gets things done. Despite official departmental obstruction, the policy of "wait and see" is at last being relegated to a well-deserved obscurity. For many years successive British Governments have dealt in the same way with vital problems of many sorts calling urgently for solution. Under the red tape system evolved during generations, the panacea—unless party political advantage seemed likely to be got by action—was delay. Since the present Government came into power there has been an extraordinary change. Decisions on all sorts of important matters are reached in a few days and action follows. When there is delay, palpable and sufficient reasons are adduced, and the obstacle is removed as soon as possible. For this reason also the hope may be encouraged that a thorough attempt to solve the London traffic problem will be made within the comparatively near future.

It is notorious that the problem has been neglected by Government after Government, and that it has become more pressing year by year; and now we have a President of the Board of Trade who is more familiar with the requirements than any man who has ever filled a ministerial position. He has both the ability and the knowledge needed to deal scientifically with the greatest traffic problem that has ever been pretented. At the moment, however, he has important national matters on hand calling for immediate study and determination. These cannot be disposed of in a day, and it is our hope that the kaleidoscope will not too soon be given another turn which will take him into spheres of activity considered higher than those of the departmental duties of the Board of Trade. On the other hand, Government changes appear for the present to be completed, and we may have some duration of the present allocation of posts. It behoves everyone concerned in the London traffic question to bring it and keep it prominently before the notice of the Government, so that under the auspices of Sir Albert Stanley a thorough, useful, and effective scheme may be evolved.

A Retrospect.

Time passes, but the problem remains and grows. New men are ever coming on the scene; and some of these fresh young energetic brains may give valuable help. To call their attention and to refresh the memories of some of the elders who are interested in traffic problems, a few points from the past may be recalled. Back in the 'eighties of the last century it began to be realised that it was hopeless to deal with the growing congestion of London street traffic or to provide better means of local communication by constructing railways as they were then known. The reason was the prohibitive cost. A new epoch began when that able pioneer, the late J. H. Greathead, put forward his scheme of deep-tunnel railways. These being constructed at a great depth avoided the necessity of purchasing land except for stations, so that capital expenditure, it was hoped, would be comparatively small. The original experiment, the first section of the

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City and South London Railway, was opened in 1890. It was also the first considerable demonstration of electric traction in this country. The possibilities of such railways were not at first widely realised, and it was not till 1900 that a second one, the Central London, was opened. The next few years, however, saw the completion of all the other "tube" railways which we now know, as well as the electrification of the Metropolitan and the Metropolitan District Railways. Then came the conversion to electric working of the suburban lines of the London, Brighton and South Coast and the London and South Western Railways, while a similar change is at present being carried out on the suburban lines of the London and North Western Railway.

Synchronising to some extent with these changes came the electrification of the tramways. The first considerable work of the kind was on the London United system in 1901, followed within a few years by the London County Council and other undertakings. All the tramways are now electrified. The change was almost immediately followed by the application of the petrol engine to the omnibus, and two or three years ago the last horse 'bus disappeared.

These were mighty changes, and changes for the better. Many journeys about London can now be made in a fraction of the time which they used to occupy. Local travelling has increased so enormously that the number of passengers per annum runs into thousands of millions. All the improved methods of travel are satisfactory, but each has its limitations. Tube railways, though cheaper to construct than surface ones, have yet proved so costly that we are not likely to see any great further development of them if dividend earning alone is allowed to govern the question. The motor omnibuses are of great utility, but they are incapable of carrying all the traffic that offers, especially during the busy hours. Demonstrably they cannot deal with "peak loads." The tramways can deal with peak loads much better, but they are handicapped by exclusion from the central and west end areas of the metropolis. The suburban lines of the trunk railways only serve their own particular districts. Throughout there is a want of co-ordination and linking together of the different systems into one great whole.

The Traffic Commission.

It was about the time when the question of improving local transit facilities had become most clamorous that the then Unionist Government appointed a Royal Commission on London Traffic to inquire and report on the whole subject. The Commission reported in 1906, and many people thought a solution was at length in sight. The recommendations included the construction of various additional railways, tramways, and new streets, and above all the creation of a Traffic Board for London, to consist of experts who would prepare and supervise the carrying out of new schemes, and who would be a controlling, co-ordinating, and organising body for every species of public passenger transit within the metropolitan area. But all hopes were disappointed, and a report of eight bulky volumes, with their elaborate maps and masses of statistical, engineering, and traffic evidence, stand catalogued but unused on the reference shelves. The reasons why the labours of the Commission, which cost the country some £20,000, came to this lame and impotent conclusion involve a peculiar tale of cross purposes, and illustrate once more the evil arising from the intrusion of party politics into practical affairs.

The London County Council naturally has a large interest in metropolitan street traffic, and in the days before the war it was divided into two parties, municipal reformers and progressives, roughly corresponding to Unionists and Liberals. In regard to public utility undertakings it has generally been recognised that where the alternative arises the former favour private enterprise while the latter prefer municipal operation. The progressive party in the Council evidently got the idea that the proposed Traffic Board for London might hamper municipal tramway enterprise as such. At any rate the progressives, who were in a majority on the Council, aided in delaying any Government action on the Commission's report. Then a Liberal Government came into power, and strangely enough this was followed by the municipal reformers securing a majority on the County Council. The latter body then approached the Government more than once with the request that the Commission's report should be carried into effect. But the Liberal Government were preoccupied with grandiose political schemes, and were too busy to deal with matters which merely concerned the daily well-being of some six million people. They realised, however, that they must show they were awake to the public need. The "wait and see" policy was accordingly put in action, and the London Traffic Branch of the Board of Trade was set up. To ensure that the question should give the Government no further trouble this new traffic branch was given no power to do anything except to collect statistics and to publish them once a year. As a soporific the plan was an immense success, and thus once again was illustrated the irony of things.

A Favourable Opportunity.

If the main recommendations of the Royal Commission were now to be carried out by legislation it is probable that the scheme would be a more satisfactory and practical one than any which might have been framed at an earlier date. Never before have we had a traffic expert at the head of the Board of Trade. Not only is the President an expert, but he has had ten years' experience of London traffic. His position during that time has associated him not only with underground railways, but with great tramway and omnibus systems in and around the metropolis. It is largely through his efforts that these three means of communication have been co-ordinated as far as voluntary private effort can go. He has been associated with undertakings owned by companies, but he has recognised all along that the first thing to do is to meet the needs of the public and offer them the utmost possible facilities. Moreover, his breadth of view, his public sympathies, are such that he could be trusted so to organise a Traffic Board that it would co-ordinate all interests and give such representation as is necessary and desirable to all metropolitan traffic undertakings, both municipal and private, and to local railways.

One of the things most urgently required is the extension of the County Council tramway system through certain parts of the central areas and the linking together of dead-end termini. This the Council have repeatedly attempted, but opposition of interested parties has proved too strong. If, however, a Traffic Board were constituted, one of its first objects would probably be to see that such extensions were carried out. At places tramway subways might be necessary. The Board would be armed with such powers that selfish local opposition would be overcome. The possibilities of the Board's activities open up a wide vista, and there seems to be no reason why it should not have some at least of such powers as are exercised by the Public Service Commission of New York. The Board would look at London's requirements as a whole as well as at the needs of particular localities. New arterial streets and additional underground railways

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would come within its purview. It might be found advantageous in some cases to combine both public money and private capital in one enterprise. The old objection of the great cost was met years ago by a demonstration of the public saving on the basis that time means money. In the coming days of national reconstruction and improvement the objection will have less weight than ever. The financial aspect of all schemes would indeed be one of the main problems that an expert Board would consider.

Meantime, however, the thing is to get the Board set up and with sufficient powers. Particular schemes would be matter for after consideration, each on its merits, and each in the light of its need, of its probable cost, and of its estimated results in the way of net annual revenue.

Not the least of the benefits would be the sweeping away of partial control by different Government departments, as well as of unreasonable vetoes by local bodies. The time is ripe for local authorities, companies, traders, and all others concerned to waive differences on the subject, and present a united demand to the Government for action. The Underground Electric Railways Company of London has long been in favour of having a Traffic Board. The London County Council is now in favour of it. Who of any consequence is against it? Let a united effort be made. Success will mean incalculable advantage to London, not merely in the near future, but in generations to come.

DUNDEE TRAMWAYS AND GOODS TRANSIT.

The question of utilising the tramways in connection with Dundee's jute industry and also for the carriage of munitions came before the Tramways Committee recently. Mr. Peter Fisher, the general manager, referred to the discussion on the transport of goods at the conference of the Municipal Tramways Association in 1916, and said that in December last he received a letter from the Munitions Transport Officer asking if the tramways could be utilised in any way in conveying munitions. He replied that they could use the lines between midnight and about 5 a.m. exclusively for the purpose, and, if necessary, to a less extent during other hours. The department had several wagons, and they had power to make sidings, etc. In the course of the discussion it was stated that the Harbour Board and the jute mills would have to consider the question, for without their aid the Corporation could do nothing. Mr. Fisher suggested that another way to bring the jute from the harbour would be by the trackless trolley system, and he was asked to communicate the suggestion to the Board and the Chamber of Commerce.

At a meeting of the Harbour Board, Mr. A. R. Mechan introduced the question, which he said was most important in view of the shortage of horses and men. There were legal difficulties so far as the Corporation were concerned in the way of their undertaking this work themselves. They could not make themselves contractors in any way, but they would be willing to give as much help as possible. The idea was to run most of the traffic at night, and they had three vehicles for the purpose. Three vehicles working at night would get over the congestion at the harbour. Mr. W. High having urged that the real solution for the problem was to be found in motor lorries, the Board remitted the matter to the Traffic Committee.

Staff Problems.—The tenth of the series of "Efficiency Meetings" of the operating department of the London Underground Railways and L.G.O.C. group was held on February 19 at the L.G.O.C. Training School, Milman Street, Chelsea. Mr. H. E. Blain presided, and the paper for the evening, entitled "Consideration of Some Staff Problems," was presented by Mr. F. H. Mercer, chief clerk to the superintendent of the line. In this paper the changes of the last 25 years in railway operation were traced, special attention being devoted to the improvements in staff conditions. The various methods of dealing with disputes, such as the Conciliation Board Scheme, were described, and methods of discipline and merit were discussed. Some interesting particulars were given as to special organisation necessary in connection with such abnormal periods as Coronation week, etc., and special problems awaiting solution after the war were entered into by a number of the subsequent speakers.

Melbourne Suburban Lines.—The proposed expenditure on railway works in Victoria during the current financial year includes £750,000 for the electrification of the Melbourne suburban lines, excluding the construction and alteration of rolling stock.

HALFPENNY FARES ON TRAMWAYS.

By a Special Correspondent.

All the signs of the times point to the condemnation of the halfpenny fare. And this condemnation proceeds not from any inherent vice in the halfpenny as a fare but from the neglect of tramway managements to give a proper and competent consideration to its aptitudes in relation to the whole scheme of fares.

The halfpenny fare has first of all to be considered in relation to the penny fare. There can be no question that the penny fare is the cardinal or basic fare in any system. The major proportion of the traffic is carried at this price. On the London County Council trams it is just about half; on the London General motor omnibuses just over half. In Leeds it is about 60 per cent. of the total; in Manchester 70 per cent.; in Liverpool almost 90 per cent. The really vital and critical problem is to get the distance which, on the average, can be carried for a penny correct. What can be afforded for a penny? Two principal factors enter into the solution of the puzzle—the cost of working the service and the density of the traffic or average load. For instance, on the London County Council Tramways the average load of a car at any point on the highest possible reckoning is only 23 passengers even in these days of overcrowding, and the cost of working a car is made up as follows:—

	Pence per car-mile (1915-16 accounts).
Working expenses	7·85
Special expenses	·59
Net earnings	3·29
Actual total	11·73
Deficiency of net earnings	·41
Renewals fund	1·00
Required total...	13·14

That is to meet all the obligations of interest and sinking fund, and to provide a modest sum for renewals calls not for the 11·73d. per car-mile as earned, but for 13·14d. per car-mile. So that each of the 23 average passengers ought to contribute ·57d. for each mile that they ride. Or, conversely, the penny fare should not permit of a ride exceeding 1·75 miles, whereas the average distance carried for a penny is just over two miles. There is the initial error.

A similar analysis cannot be given for the London General motor omnibuses, because the requisite figures are not published.

The second aspect of the problem then comes into view. Should the halfpenny fare be available for half the penny distance, or should it extend only to some less distance? With the object of protecting the staple penny traffic, there is no doubt that it should be less, and the next simple fraction, the third, seems the most obviously suitable one. The adoption of such a basis gives rise to a most equitable and convenient scheme of fares based on three stages for a penny with double overlaps. Everyone gets a reasonable ride for his money. This was the original Glasgow system, but prosperity there induced the Corporation to give four stages for the penny, and ultimately two stages for a halfpenny. The result is striking as showing how the halfpenny traffic will eat into the penny traffic, for there the halfpenny traffic in 1915-16 was 42 per cent., the penny only 34 per cent., of the whole. If it were not for the extraordinary density of the traffic, about 28 passengers per car, and the lower total receipt per car-mile, (11d.) required to meet all liabilities, the service could not be offered at so low a rate of charge.

The advantages of halfpenny fares when they offer a less distance than half that offered for a penny are

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twofold. In the first place, the rate of earning per car-mile must for the same load be higher, or, conversely, fewer passengers are required at halfpenny fares on the average to realise the same earnings. Clearly, if a penny passenger can travel 1·8 miles and a halfpenny passenger only ·6 of a mile, and the load of the car remains constant at 24, the halfpenny passengers will have contributed half as much again as the penny passengers on any journey.

The invitation of the halfpenny fare induces a full up traffic. That is the second advantage. As a car runs through a busy street it picks up and sets down all the time. It turns over its traffic. As shown above, with a careful fares scheme the more frequently the traffic is turned over the more profitable it is. But, say some, the halfpenny passenger crowds out the penny one and causes a loss. That is only true if, when the halfpenny passenger alights, there is not another one to take his place—and the general occurrence is that there is such another. Really the halfpenny passenger is a safety valve on a busy route, enabling business to be transacted throughout its length. Thus the two advantages combined make of the halfpenny fare a valuable auxiliary to good earnings.

How is it, then, that there is this outcry against the halfpenny fare? How is it that the authorities allege that the halfpenny fare results in a loss? The answer is that there is a confusion of thought. There is a misuse and a misunderstanding of average results. Because, they say, the average cost per passenger is over a halfpenny, you cannot afford to carrry a passenger at a halfpenny. But an average cost can only have relation to an average earning. Both these averages can be roughly analysed into so many passengers below the average in both earning and cost, so many at the average, and so many above the average. For cost has relation to service rendered just as much as fare paid. What is wanted is a fares scheme to give the average result required. This average result for prosperity must on present costs be something more than a penny. This means that the number of passengers paying more than a penny must be greater than the number of passengers paying less than a penny, i.e., the halfpenny. This means, again, a right apportionment of distance to the fare paid. It leads back to the scheme of fares already discussed.

Yet there are certain cautions in the application of halfpenny fares that in fairness should not be overlooked. At terminals where the loading is heavy and at other congested points it may be desirable to omit the halfpenny for an odd stage. The circumstances of collection may be such as to render the collection of the fare impossible, and this is a real loss. Again, halfpenny fares are impracticable in sparsely-loaded sections. They could not be advantageously employed on country routes. There would not be a frequent enough succession of passengers to make them remunerative. Or again, the value of the service is worth more. This, too, applies to congested central areas, where the slower working speed increases operating costs and the difficulty of moving freely about enhances the value received in travel, and so justifies a minimum penny. Or yet again, the character of the neighbourhood may govern the policy to be adopted. The West End of London slightingly regards its halfpennies; not so the East End. The money available for fares and the social standing of the passengers must not be overlooked. There are more first-class carriages on the Brighton trains than on the Southend trains. The street car is only one class, but its price settles the predominant class of the moment. Considerations of this kind are only reasonable.

The object of this brief article is to ensure that there is this consideration before a decision is finally taken antagonistic to halfpenny fares on principle. On grounds of expediency arising out of special war conditions, there may be a case for their suspension but not for their abolition. Depreciation in the value of money, restricted services, overcrowding and defective fare collection, enhanced costs, all point to a simplification of the fares and a general higher level of charge. But expediency must not permanently oust principle.

AMERICAN ELECTRIC RAILWAYS FOR DEFENCE.

The large extent to which the tramways of the United States of America provide interurban connection appears likely to render the undertakings of great utility in the civilian movement which is in progress to assist the War Department in the defence of the country. For this purpose various great interests have formed a Committee on Co-operation with the War Department. General G. H. Harries, who is the chairman of the committee, on February 7 sent the following telegram from Omaha, Neb., to Mr. E. B. Burritt, the secretary of the American Electric Railway Association, New York:—

"Responding to your telegram this date, I would say that the most important field of usefulness of electric railways in the matter of aiding in national defence is in connection with transportation of men and material from and to standard steam lines to our coast artillery posts. Of course there will be other opportunities for co-operation in connection with transportation to and from mobilisation camps throughout the country, these lines, however, almost invariably acting as distributors to and from standard steam roads.

"The first thing of value which can be done by the electric railways will be to contribute promptly and fully all information called for by the Committee on Co-operation with the War Department. Without the necessary data it will be impossible to create any workable plan.

"The problem of effective partnership between the steam and electric roads will be by no means capable of easy solution. The desire of the association's committees is to find out how many electric roads are in shape to handle without breaking bulk the heavy material which may be conveyed to junction points by steam and how many others there are which could be rapidly made fit for such service. Motive power, track curvature, clearances, and bridges have to be primarily considered. In the many cases where electric roads will be unable to handle steam rolling stock we must be informed as to the usable equipment which can be depended upon, so that there will be no guesswork as to the number of troops or the tonnage of supplies that could be successfully handled in the shortest practicable period of time.

"To attempt to set forth just now the questions which the committee may find it necessary to ask is neither practicable nor necessary. Every operating official can easily visualise the situation, and will appreciate the difficulties which with the assistance of the federal government may have to be met and overcome.

"Very few of our coast defence posts are without electric railway connection with near-by towns. Very few of these posts have anything like direct steam connection. What we therefore desire to know is the physical relationship of steam and electric carriers, the ability or inability of the several electric roads to maintain effective transportation communication with steam roads, and then we must have the facts as to the manner in which men and supplies can be handled either regularly or in time of emergency.

The best service which can now be rendered by member companies will be the speediest possible reply to any inquiries sent out by the committee and by volunteering such suggestions or information as will be calculated to assist the committee in doing its work."

Safety First Campaign. In the report for the year ended December 31 last the directors of the London General Omnibus Company refer to the special attention which has been paid during the past year to the prevention of accidents both in connection with its own employees and the public. The "safety first" campaign has been very effective, and the reduction of omnibus accidents by over 20 per cent. has led the company to enlist the co-operation of the Metropolitan local authorities, transportation companies, etc. A report of the first conference held in London in December last was given in our issue of February 8.

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LONDON, MARCH 15, 1917.

A Record in Tramway Finance.

A luncheon which took place at the end of February in the Glasgow City Chambers marked the completion of the most notable financial achievement in the history of tramways. The essential act of the day was the handing over by the tramway department to the city treasurer of a cheque for £2,328,890. This sum, with the amount of the sinking fund already accumulated, completely extinguished the capital debt of the undertaking—namely, £3,835,157. How it has been done in the short period of sixteen years has already been indicated in our pages. Here it will be sufficient to say that the marvel has been actually visualised by the transfer of the balance of the required sum from the depreciation and permanent way renewal fund. That fund, it should be pointed out, reached such proportions because, in the first place, the undertaking has been highly prosperous, and in the second place because surplus profits have not been paid away in relief of the rates. The result is that genuine relief comes in another and a better form, because, except for any further capital expenditure, there will be no more sinking fund nor interest payments to make. Contributions to the depreciation fund will be continued on a smaller scale, and the great potential surpluses of the future may be used either for further reducing fares or for contributing more money to that admirable municipal fund, the Common Good. The annual gross revenue from one hundred miles of route now considerably exceeds a million sterling. Sir James Bell, who was Lord Provost of Glasgow when the tramways were taken over by the Corporation in 1894, delivered a speech at the luncheon which was full of interesting reminiscences. But so far as the report of the proceedings shows, no mention was made of the three men who probably more than any others were responsible for laying the foundations of the undertaking, and were for a time its guiding spirits. First, there was the late Bailie Walter Paton, convener of the Tramways Committee for many years. He was an originator and a director of policy during the horse traction days and well into the electric period. Of great business ability, keen, shrewd, he at the same time possessed a quiet and kindly geniality which endeared him to all who had the privilege of knowing him. Then there was Mr. John Young, appointed general manager before the working of the tramways was taken over from the lessees. A capable organiser and manager, he was the originator of the tramway department, and he conducted the undertaking through many initial difficulties with brilliant success until the time came when he sought other fields of activity. Third, there was Dr. H. F. Parshall, the consulting electrical engineer, who designed the power and distribution plant. It was one of the first examples in this country of the three-phase high-tension system of generation and transmission to sub-stations, with conversion there to low-tension direct current for feeding the trolley wires. How excellently the scheme has worked, both electrically and financially, experience ever since the beginning of this century has fully shown. Associated with Mr. Young in the administration of the undertaking from its beginning, Mr. James Dalrymple has proved a worthy successor. He combines the qualities of manager in the truest sense of the word with special financial knowledge and ability. Under his direction it is not surprising that the undertaking goes on from success to success.

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Successful Railway Electrification.

Railway electrification receives a great endorsement by the decision of the directors of the Chicago, Milwaukee and St. Paul Railway to extend electrical working on 220 miles of line to the west of the present electric zone. Further particulars are given elsewhere in this issue, and the importance of the projected work will be seen at a glance. The new plans have been under consideration for some time, and their adoption may be taken as the final seal of approval by the directors and engineers of the company on the results of their great experiment. Since electric operation was first applied on the St. Paul, ample time has elapsed to enable the officers to ascertain what exactly are the advantages that they have secured; and their determination to proceed is a sufficient indication that their anticipations have been fully realised. Economies have been effected to such a degree that apparently no other course was left to the company than to apply electric working to other sections of the line as soon as practicable. No less than 440 miles are now worked over by electric locomotives; 220 miles are to be added without delay, and it is not unreasonable to look forward to the time when on nearly 1,000 miles of railway eastward from the Pacific Coast the steam locomotive will be superseded. Already the St. Paul Railway has demonstrated on a scale greater than has ever before been attempted the economy and reliability of electric locomotives in the heaviest service. Although no orders have yet been placed for the new equipment required, it is stated that the same type of locomotives will be adopted, a decision that must be highly gratifying to the American General Electric Company, which supplied the earlier machines. In other respects the electrification will be carried out in a manner similar to that previously adopted. Energy will be generated at 100,000 volts in a hydro-electric station, and transmitted to sub-stations placed 30 miles apart. From these stations direct current at 3,000 volts will be supplied to the catenary contact system, and thence to the powerful electric locomotives weighing 280 tons. The whole undertaking is on a scale of such magnitude as to dwarf all examples of steam railway electrification in this country; but our electrified lines are in their measure as successful as that of the St. Paul, and if the times had been normal, there is no doubt that further extensive plans would already have been announced by several British railways.

Increase in Tramway Fares.

A valued correspondent discusses in this issue in a clear and convincing way the vexed question of the halfpenny fare. Tramway managers who have had in many cases painful experience of the effect of these fares may be disinclined to view the matter with an open mind; but if they will read carefully the argument of our correspondent, we think that they will admit that on principle the question still needs careful consideration. On grounds of expediency in the difficult existing conditions, however, a decision adverse to these low fares is probable in most cases; and happier times must be awaited before a return to them can be considered practicable. If they had been granted after more careful study of the conditions of each undertaking it is probable that their suspension might have been delayed longer, if not altogether avoided. In some cases due consideration would have shown that a halfpenny fare never could be justified; in others its success would depend upon its careful apportionment with respect to the penny stage. As our correspondent says, there is no inherent vice in the halfpenny fare as such. Wrongfully applied, however, it may easily ruin a good tramway proposal; skilfully systematised, on the other hand, it may prove a valuable auxiliary. It must never be allowed to interfere with the earning power of the penny fare, which will always continue to be the essential factor. Had that fact been given sufficient weight the present circumstances might not have rendered necessary certain changes that are now taking place. Speaking generally, there is no doubt that tramway fare schemes have been cut too fine even for normal times. To-day they are in many cases utterly inadequate. Increased wages, war bonuses and allowances, and the advanced prices of all supplies constitute a burden that will be increasingly serious. It must be remembered that in the case of the great majority of our tramways, both private and municipal, the excess of earnings over

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expenses has always been too small to permit thorough upkeep and the steady improvement of the service. Too great emphasis has been put on economy, and too little on enterprise. In many cases the service before the war in frequency, speed, and comfort was no better than when the cars were first run. It is not surprising then that war time conditions leave no choice but an increase in fares. Our news columns have indicated the changes that have already been effected, and others must come. Naturally the public complain, but the answer is that in times of peace the limits of possible liberality had been strained. Low fares and payments in aid of rates had left the undertakings bereft of resources, and the surprising thing is that so many have been able to continue to maintain the old fare schedules. Without the extraordinary increase in traffic due to war conditions they could not have done so. Those conditions are not likely to persist after peace has been restored, and consequently it is a prudent course for tramway administrators to consider whether, although they may so far have escaped financial difficulties, they are justified in indefinitely postponing alterations in fares. They have yet to face heavy demands for renewals and additions to equipment. The longer the war continues—and the end is not yet discernible—the more onerous will those demands become.

Employment of Women. Now that the Home Office has rendered it possible for women to act as drivers of public service vehicles in London, more than one tramway undertaking is likely to experiment in following the example set in Glasgow and many other towns. The present period, unfortunately, is not favourable to introducing women to a by no means inviting sphere of work. During the last week in February the Army Council issued their appeal to women between 20 and 40 years of age to undertake motor transport, domestic, postal, and clerical work with the army at home and in France, and since that date the Director of National Service has begun to register the names of women who are willing to take employment on the land and in other directions. Although a certain number of women may be diverted to army work from traction undertakings, the rate of pay offered does not compete with that earned by women conductors and drivers except in the arduous labour associated with the motor transport vehicles. There are indications, however, that tramcar and omnibus conductors are not so enamoured of their employment as was the case in the first year of the war, and the management may find it increasingly difficult not only to retain those who are grumbling but to secure recruits. Extensions of welfare work and a reduction of hours are directions in which attention might be turned, especially if, as is likely to be the case, the new hands have to come from those below the minimum age set for women taking up military work. Possibly the increased bonus granted to men, but withheld from women by the Committee on Production, may have to be conceded in towns in which the unions are agitating for a concession that several of the important undertakings have granted. It is not fair to married men, however, that a young woman with no dependants should be treated as liberally as the former. That it is difficult to maintain the numbers of women conductors is shown by the statement that the London General Omnibus Company place not far short of 150 new conductors on their vehicles every week to fill vacancies in a staff of nearly 2,500 women collectors. An insight into tramway experience is afforded by the report published at the end of January that of 600 women employed on the Manchester cars 225 had resigned. Judging by the experience of managers elsewhere, the women employees entertain less regard for discipline and punctuality, while in one important town it was stated recently that besides the question of the bonus they were dissatisfied in many ways, and were playing on the sympathy of the public by declaring that the work was of too hard a nature. In most towns the management have shortened the hours of the women staff and in so doing they have acted wisely, especially in view of the trying conditions entailed by the lighting restrictions. The question of hours is a reminder that the unions made a mistake when they insisted upon the women receiving the same pay and working the same number of hours as the men.

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TRADE AFTER THE WAR.

A Real Step Forward.

The drastic proposals of the Government for the prohibition of the importation of many classes of non-essential commodities and for restriction of the imports of other goods have since the latter days of February turned the attention of the public almost exclusively to economics. This attention is directed, however, to importation, production, and consumption of goods at the moment and in the near future. It does not so much concern our future development of manufactures and export trade. What does concern the latter subjects, and what has for a little been thrown into the background, is the report by Lord Balfour's Committee recommending preferential trade within the Empire. In the light of present circumstances and of the general action of the new Government, this is a momentous declaration. It is momentous because there appears to be every prospect that it will be carried into execution.

Let us go back a little and try to see what it means. In June last year an Economic Conference of the Allies was held in Paris, at which a set of resolutions were passed which have since been famous. They were of necessity couched in general terms, but they made it clear that all the Allies were determined that in future they would be economically independent of Germany and Austria. They also showed the desire for preferential trade between the Allied nations and for a strong tariff wall against enemy countries. Each of the Allies was left free to devise the best methods, in the light of its own national interests, of carrying the principles into practice. There were also general indications in the resolutions of means for fostering and developing the trade of the Allies. The late British Government, inspired by Mr. Asquith, moved slowly and cautiously after the results of the conference had been announced. The lessons of the war, however, were being learned, and that Government, composed largely of old-fashioned free traders, intimated general adherence to the resolutions. They also constituted a number of committees of experts, each to examine into the conditions of a particular trade or industry, and to inquire how best it might be developed after the war. This was followed up in July by the appointment of the Committee presided over by Lord Balfour of Burleigh to take a comprehensive view of the situation and to obtain light from the findings of the separate trade Committees. Some of the members of Lord Balfour's Committee were, in fact, members of the trade Committees. Lord Balfour and his colleagues were required to consider the commercial and industrial policy to be adopted after the war, with special reference to the conclusions reached at the Economic Conference of the Allies, and to the following questions :—(*a*) What industries are essential to the future safety of the nation and what steps should be taken to maintain and establish them ? (*b*) What steps should be taken to recover home and foreign trade lost during the war and to secure new markets ? (*c*) To what extent and by what means the resources of the Empire should and can be developed ? (*d*) To what extent and by what means the sources of supply within the Empire can be prevented from falling under foreign control ?

This was a very large task, and it is not surprising that the report which the Committee issued on February 21 is only a preliminary one. It was, however, understood that the main findings of the Committee should be available before an Imperial Conference on the subject was held. The new Government, under the Premiership of Mr. Lloyd George, which came into existence last December, have speeded up the holding of this conference, and it is to assemble shortly. That being so, the Committee have in the meantime produced three resolutions, which they have arrived at with practical unanimity. The first declares that special steps must be taken to stimulate the production of foodstuffs, raw materials, and manufactured articles within the Empire. The second recommends that the Government should now declare their adherence to the principle that preference should be accorded to the products and manufactures of the British overseas dominions in respect of customs duties. The third resolution declares that it is necessary to take into early consideration the desirability of establishing a wider range of customs duties which would be remitted or reduced on the products and manufactures of the Empire, and which would form the basis of commercial treaties with allied and neutral Powers.

These points are briefly expressed, but if carried into effect they involve a revolution in the trade policy of this country. Moreover, the majority of the members of the Committee were free traders before the war. Lord Balfour himself was a staunch free trader. But they have come to see the necessities of the times. Indeed, they say so in their letter to the Prime Minister accompanying the resolutions. The Committee promise as soon as possible to report at length on all the aspects of the subject, including the precautions to be taken to prevent any troubles or difficulties which might arise. Meantime, however, we may expect the Government representatives to go to the Imperial Conference with a mandate in favour of preferential trade within the Empire. Such a proposal will, of course, be welcomed by the dominions. It is the beginning of big things. The energy displayed by the present Government warrants one in speaking with more certainty than was possible in past times.

The British Electrical and Allied Manufacturers' Association are specially to be congratulated on these prospects. They have been one of the foremost bodies in advocating imperial preferential trade.

MELBOURNE TRAMWAY ARBITRATION.

At Melbourne on January 19, Mr. Justice Cussen delivered his award as arbitrator in the question of the amount of compensation to be paid by Melbourne Tramways Board to the Tramways and Omnibus Company, Limited, in respect to several things comprised in the tramway undertaking which are not the subject of the leases. He determined the amount of compensation to be £335,000. The company had claimed £469,000 when the hearing of the arbitration was begun, but this amount was reduced to £138,000 in the course of the proceedings.

Mr. Justice Cussen said : In arriving at the amount of compensation, I have given effect to the following principles or matters :

I have had regard to June 30, 1916, as the date in relation to which the value of the said " things " was to be ascertained.

In respect of many of the said things, including rolling stock, I have fixed their values by considering them as things *in situ* (or established, assembled, and arranged), capable of earning a profit, and in many cases this, in my view, necessitated fixing values practically by reference to structural cost, less a proper deduction for depreciation.

In fixing these values I have not regarded the possibility or probability of the cable tramway system being converted into an electrical tramway system, or considered statements made by witnesses on that subject.

Proceeding to give a statement of his reasons for adopting certain principles, etc., with respect to fixing the value of some of the things, the arbitrator said he took that course in order that, if he had come to a wrong conclusion on any item, he might be more easily set right, and that the amount of the award might be varied accordingly. He thought that June 30, 1916, was the correct date under which the Tramways Board gave what was called a notice of acquisition. For two reasons this notice did not absolutely determine the things which were in fact required, first, because the company—as it was entitled to do—in effect insisted on the board acquiring other things ; and, secondly, because even after the notice of retention the things to be acquired were subject to additions

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and deductions in the ordinary course of business. The second question related to the mode of valuing the major part of the disputed items. It was contended by the company that, speaking generally, the things should be valued as things *in situ*, capable of earning a profit, and by the board that they should be valued at what they would fetch at auction, or in the market. The board's contention was, in certain aspects, pushed to the extent of depriving the company in respect of certain things of anything more than "scrap" value. In his opinion he must give effect to the company's contention. He quoted section 34 of the Tramways Board Act, 1915, in support of his view, the Act having been introduced by the Government to create a new Tramways Board as successors in law of the Tramways Trust. In the Act was shown an intention that in valuing the "things" they were to be considered as part of and incidental to the Metropolitan Cable Tramway undertaking, and that in order that there might be no interruption to the traffic they were to be taken over by the body which was to continue the work of this undertaking, the company having no further right to do so. The application of that principle justified that he should in some cases ascertain the cost of replacement, and that in its turn necessitated, in cases of special constructions, such as rolling stock and material therefor, that he should consider structural cost, less deduction for depreciation. The next matter related to a contention by the board that even if he adopted replacement value he should, in fixing that value, and especially in measuring depreciation, take into account statements by witnesses as to the strong probability, if not practical certainty, of the cable tramways being converted in a few years into an electrical system. He doubted whether the circumstances were not so special and intricate as to prevent his accepting statements of opinion on such a matter; and he said that without intending the slightest reflection on the witnesses. On the question of the interpretation of the lease, he did not think that it was intended to bring about a permanent fixed charge in favour of the Trust on cables which the company might at any time have used. In his opinion, what the trust was entitled to get at the end of the leases were the cables then on the lines. If these were not in good working condition, the company might be liable either under its bond or otherwise.

The arbitration occupied twenty-five days, and Mr. Justice Cussen expressed his indebtedness to counsel. He recognised that behind them there had been an immense amount of work and skill and ability shown in the preparation of documents produced.

We may add that Mr. P. J. Pringle, chief engineer and general manager, Electric Supply Company of Victoria, Limited, acted as consulting engineer and assessor in the Melbourne Tramways Board. The board recently issued a writ against the company, claiming failure on the part of the latter to maintain the track and power houses under the conditions set out in the lease. Mr. Pringle is acting in a similar capacity in this suit.

Restriction of Catalogues, etc.—Under the Paper Restriction Order, 1917, the exhibition of posters and the posting and delivery of catalogues, price lists, etc., were strictly limited as from March 10. The Paper Commission has announced that the days of grace have been extended to March 17.

GLASGOW CORPORATION TRAMWAYS CELEBRATE THE EXTINCTION OF THE DEBT.

At a luncheon given on February 22 by the Glasgow Corporation Tramways Committee in celebration of the extinction of the debt on the tramways undertaking, Bailie M'Naughton, convener of the Tramways Sub-committee on Finance, handed to treasurer M'Millan a cheque for £2,328,889 15s. 4d. to wipe out the balance of the tramway debt owing to the Common Good Fund. The details of this transaction, based on the depreciation and permanent way renewals investment account, were given in our issue of February 8, as submitted in a report presented by Mr. Jas. Dalrymple, the general manager to the Tramways Committee, on January 31.

Dr. Montgomery, convener of the committee, presided at the luncheon, at which Sir James Bell, who was Lord Provost when the Corporation took over the horse tramways in 1894, proposed the toast of "The Tramways Committee." Sir James recalled that as the result of the first year's working of the horse tramways the committee were able to put aside the contributions to the sinking and depreciation funds, and to contribute £8,000 to the Common Good. Last year they had 362,000,000 passengers, and of that number 232,000,000, or 66 per cent., travelled by halfpenny fares. At present every person in Glasgow was spending on an average about 22s. a year in fares. The earnings last year were £1,149,000, and out of that sum £485,000 was gathered in halfpenny fares. If they had not instituted the halfpenny fare there would have been half a million more out of the pockets of the people, and he questioned if the tramways would have been so successful and the service so much a boon to the community as they had been. In 1898 the tramways were electrified, and the undertaking progressed until £3,835,000 had been spent on capital account. Altogether the tramway system had drawn £4,600,000 over and above the expenditure. That enormous sum had enabled them to square all accounts. With every debt extinguished, they started afresh with £119,000 in hand. To crown all, when the nation came to demand money for the nation's needs the Corporation gave the largest donation he knew of any municipality in the kingdom. That £2,000,000 to the War Loan was founded on the tramway system.

GLASGOW CORPORATION TRAMWAYS.

46 BATH STREET,

No. 17820 Glasgow, 22nd February 1917.

ONE PENNY

To The Bank of Scotland, Glasgow.

Pay to Corporation of Glasgow or Order

the sum of two million three hundred & twenty eight thousand eight hundred & eighty nine pounds 15/4

£2328889 · 15 · 4

Member of Finance Committee.

General Manager.

Cheque for the Liquidation of Glasgow Tramways' Debt.

Councillor Montgomery, in responding to the toast, said they were celebrating the extinction of the debt in the comparatively short time of 16 years. The question was asked—How had it been done? The answer was very simple. The committee from the beginning had had the ideal before them of giving the best and cheapest service it was possible to give, and in consequence of that the citizens had given the department a most extraordinary revenue. The revenue in 1902 was £600,000; it would this year almost approach one and a quarter millions. The department did not invest these funds in outside securities. They invested them in the best of all securities, the undertaking itself, and that was the next great secret. The department was the backbone of the Common Good, and, if he could see right, in the future it would comprise its entire anatomy. In adverting to the work the department had rendered in the national cause since the outbreak of war, the convener congratulated Mr. Dalrymple and the staff on their efforts.

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LONDON COUNTY COUNCIL TRAMWAYS REORGANISATION.

ADOPTION OF THE SPECIAL COMMITTEE'S RECOMMENDATIONS.

At the meeting of the London County Council on February 20 the Highways Committee presented a report embracing the recommendations of the special sub-committee appointed in August last to inquire into and report upon the organisation and working of the Council's tramways. The full text of the report, which was unanimously adopted, is appended. The recommendations are included in Part VIII. (page 175).

I.—PRELIMINARY.

On July 18, 1916, in connection with the consideration by the Council of the annual estimates for 1916-17, we reported that we were closely investigating the present position of the tramways undertaking; and on August 1, 1916, we reported the appointment of a special sub-committee to inquire into and report upon the organisation and working of the undertaking. The sub-committee, of which Mr. F. C. Harrison is chairman, sat throughout the summer recess, and has since been in regular session.

The sub-committee decided in the first instance to review the present organisation of the tramways department. They were aware that the filling of certain vacancies in the higher staff of the department was urgently necessary, and it was evident that the question of filling these vacancies could not be dissociated from the need for reorganisation. They found it necessary, therefore, to make a searching inquiry into the present organisation, and to decide upon the main features of reorganisation before settling their proposals for the filling of vacancies.

The chief officer of tramways laid before the sub-committee his proposals for reorganisation. The sub-committee, who had full regard to these proposals, had the advantage of the attendance of the chief officer at some of their earlier meetings before he was compelled, unfortunately, to be again absent from his duties owing to illness. In the absence of the chief officer the deputy chief officer was present at the meetings of the sub-committee, who recorded their appreciation of the valuable assistance he had given to them. The sub-committee also had the advantage of the attendance before them of many of the officers of the department, whose statements with regard to the duties discharged by them were of material assistance.

The sub-committee have now submitted to us their report on the reorganisation of the department, and after careful consideration the report has received our unanimous approval. Certain matters connected with the reorganisation but not affecting its main outline and purpose remain for consideration, as indicated below, and will be the subject of further report.

Whilst the sub-committee were engaged on the work of reorganisation, important financial questions bearing on tramways operation remained under our immediate consideration and have received our closest attention. In order to enable us to bring before the Council at the earliest possible moment proposals with regard to the financial position of the undertaking, we have recently appointed a sub-committee, of which the vice-chairman of the Council has been appointed chairman, and Mr. T. F. Hobson vice-chairman, to report what alterations, if any, should be made in connection with tramways operation, with particular reference to services and fares and methods of collection of fares. We shall report upon these important financial questions at the earliest possible date. Meanwhile, we are convinced that in the best interests of the service our proposals for the reorganisation of the tramways department should be adopted without delay.

II.—PRESENT ORGANISATION OF THE DEPARTMENT.

The position of the chief officer of tramways is defined by the Council's resolution of March 29, 1899 (Regulation No. 680), as follows:—

The chief officer of tramways shall have control of the staff exclusively employed in connection with the working, maintenance, repair, and renewal of the tramways, and with the maintenance, repair, and construction of the cars and other vehicles used on or in connection with the tramways, and except as regards officers appointed under any scheme of classification approved by the Council, he shall have power to appoint and to dismiss any person under him and he shall be responsible for the conduct of the entire staff, and generally for the efficient working of the tramways undertaking under his charge.

The deputy chief officer (£1,000 a year) has no specially assigned duties, such as the control of any particular branch of the service, his duties being those attaching naturally to the position of deputy.

The department is divided into ten sections, as shown on the diagram following this report. Particulars are as follow:—

(1) *Electrical Section.*—The head of the section is the electrical assistant (£800, position vacant since September, 1915), who is responsible for the power supply and distribution. The work of the section is divided into three sub-sections, viz., (i.) generating station—superintendent of the station (£450), senior charge engineer (£345); (ii.) resident electrical superintendent, southern section (£450); and (iii.) resident electrical superintendent, northern section (£400). From time to time expert electrical engineers are consulted as found necessary in connection with the more important work of the section.

(2) *General Section.*—The head of the section is the general assistant (£600), who deals with the general correspondence and other matters, and supervises (i.) the correspondence branch, and (ii.) the drawing office and Parliamentary branch.

(3) *Traffic Section.*—The head of the section is the traffic assistant (£600, position vacant since October, 1916), who is responsible for the whole of the traffic arrangements. For traffic purposes the tramways system is divided into three sections, viz., (i.) the southern section, and (ii.) the northern section, each under the supervision of a district traffic superintendent (southern, £350; northern, £300); and (iii.) the tramway between Harrow Road and High Street, Wandsworth, under the supervision of a district superintendent (90s. a week). Under the district traffic superintendents are several divisional superintendents. Each of the latter supervises a number of the divisional inspectors, traffic regulators, and ticket inspectors, proportionate to the area controlled, and is responsible for the efficient running of the car service in his district and the staff allocated thereto.

(4) *Permanent Way Section.*—The head of the section is the permanent way engineer (£600), who is responsible for the maintenance, repair, and renewal of all the track and special work on the tramways operated by the Council. There are two assistant permanent way engineers (£300 each), one for the district north and one for the district south of the Thames; and under these officers there are two district foremen (60s. to 90s. a week) supervising workmen's gangs. There are seven permanent way depots, each of which is under a foreman (50s. to 65s. a week).

(5) *Accountant's Section.*—The head of the section is the tramways accountant (£500), who undertakes, in addition to other duties, such accountancy work in connection with the undertaking as is not carried out by the comptroller of the Council. There is an assistant accountant (£350). The section is divided into branches, viz., (i.) book-keeping branch; (ii.) invoice branch; (iii.) paymaster's branch; (iv.) wage appropriation and checking branch; (v.) cash counting, distributing, and banking branch; (vi.) printing shop; (vii.) stores branch (stores superintendent, £350).

(6) *Rolling Stock Section.*—The head of the section is the rolling stock superintendent (£525), who supervises the maintenance and renewal of all cars and other vehicles operated by the department, and has supervision of the central car repair depot and other depots. The principal assistants in this section are the assistant rolling stock superintendent (£325) and the superintendent of the central car repair depot (£300).

(7) *Claims Section.*—The head of the section is the claims superintendent (£550), who deals with all reports of accidents to persons and damage to the Council's cars and other property in connection with the working of the tramways, also all matters relating to the Council's piers.

(8) *Advertising Section.*—The position of advertising assistant (£550), who undertook the work of obtaining advertisements on the Council's cars, has been vacant since March, 1916. Since April 1, 1914, Messrs. W. H. Smith and Son have been sole agents for obtaining advertisements on the Council's cars, the arrangements being for a period of nine years.

(9) *Building Section.*—The head of the section is the building superintendent (£350), who undertakes the repair, painting, and maintenance of all premises in the occupation of the department, and all other jobbing work where building workmen are required, maintains the Council's piers, and assesses damage to property.

(10) *Ticket Punch and Checking Section.*—The head of the section is the (woman) superintendent of women checkers (£250), who deals with all tickets, punches, and waybills; prepares statistics relating to receipts, passengers, and car-mileage; and supervises arrangements for women conductors at the depots.

Up to 1910 two of the principal officers in the department were designated electrical engineer (£1,200 a year) and traffic manager (£950 a year, rising to £1,000 a year), but consequent upon the resignation of the then electrical engineer these designations were abolished, and their successors designated electrical assistant (£800 a year) and traffic assistant (£600 a year) respectively. At the same time there was created the position of deputy chief officer of tramways (£950 a year, rising to £1,000), which was filled by the promotion of the former traffic manager.

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The co-ordination of the work of the several sections is secured by the chief officer's personal direction of the work of each section, and by departmental conferences, held from time to time, over which the chief officer presides. These conferences are attended by the heads of sections concerned in matters arising for consideration.

III.—NEED FOR REORGANISATION.

The present organisation has resulted largely from the natural growth of the department, which from time to time absorbed the staffs of purchased companies' undertakings, and subsequently expanded with the development of the tramways system. The following figures, illustrating the growth of the undertaking, are taken from the published accounts for the first complete year after the Council commenced the working of the tramways, compared with similar information for the year ended March 31, 1914 : –

	March 31, 1900.	March 31, 1914.
Miles of track open	24·375	144·83
Car-miles run	10,208,161	59,209,289
Passengers carried	117,992,713	522,952,640
Total revenue	£470,098	£2,268,668
Total number of employees ...	2,750	12,232

During the same period the capital expenditure on the undertaking increased from £1,710,056 to £13,028,120.

The growth in working costs and the increasing complexity of passenger traffic operation in London would alone justify a review of the organisation of the department and compel attention to the necessity for a most careful scrutiny of every part of the departmental machinery. The present time is particularly opportune for any necessary alterations in organisation, since there are several vacancies in the higher ranks of the department, and arrangements for filling some of them are urgently necessary.

The need for reorganisation has been realised for a considerable time, not only by members of the committee, but also by the chief officer, who was prevented by pressure of work and the special difficulties created by war conditions from submitting at an earlier period proposals for reform.

Owing to departmental conditions the chief officer has hitherto been compelled to devote much time and attention to ordinary executive business, whilst the division of the department into ten sections has also rendered necessary great efforts in co-ordination. For these reasons he has been hampered in dealing with such important matters as the development and improvement of the system and the consideration of larger questions of tramways working and policy. We are satisfied that the remedy lies in devolution.

There is room for considerable improvement in the status of the technical and professional officers in charge of the principal sections, and more effective use could be made of their services. The number of sections into which the department is divided is too large, co-ordination of the work being thus rendered unduly difficult. In the traffic section, in which no risks should be taken likely to prejudice successful working, we find that it is necessary to add to and improve the existing departmental machinery, in order, *inter alia*, to secure more fully the necessary data for the purpose of effecting improvements. We have observed also that the principal subordinate officers have not sufficient authority to decide executive and disciplinary matters of comparatively minor importance which might well be left to their discretion. These and other matters that have engaged our attention are the subject of proposals which we make for reorganisation.

IV.—BASIS OF REORGANISATION.

(1) Preliminary.

The proposals in this report are divisible as to matters requiring the decision of the Council and those determinable by us. With regard to matters submitted for the Council's decision there are references throughout the report to the appropriate recommendations. In most cases our resolutions and rules are dependent for their operation on the decisions at which the Council arrives on our recommendations.

(2) Considerations Affecting the Work of the Committee.

The clerk of the Council has advised us that but for the war the Special Committee on Procedure would have given consideration to proposals the adoption of which would have had the effect of relieving us of much detail work. Whilst we are required under existing procedure to deal with a large amount of detail work, matters the consideration of which should be the principal business at our meetings fail to receive adequate attention. As a war expedient our chairman has recently undertaken to examine carefully all reports and matters of routine, with the object of relieving our agenda paper and enabling us to give more time to the larger questions of tramways working and policy.

(3) Main Features of Reorganisation.

For reasons already indicated the chief officer should be relieved of much work which he now carries out personally. This relief can be effected, with consequent advantage to the organisation in other respects, by a considered system of devolution, under which the principal subordinate officers will act in certain matters upon general lines.

Position of Deputy Chief Officer.—We are of opinion that the position of deputy chief officer should be abolished as a separate appointment. Under our proposals there will be several officers of sufficient standing who could be called on to discharge the duties of chief officer in his absence, and upon these officers the work hitherto performed by the deputy chief officer will automatically devolve. We consider it undesirable to attach to the position of head of a particular branch the function of deputy, and think it preferable to decide from time to time which officer shall ordinarily discharge the duties of the chief officer in the absence of the latter.

Reduction in Number of Branches.—Particulars of the ten sections into which the department is at present divided have been given in Part II. of this report. Our reorganisation proposes the grouping of the work in five branches. (See accompanying diagram.) Of the present ten sections the traffic, electrical, rolling stock, and permanent way sections become separate branches in the new organisation. The remaining work of the department, subject to certain appropriations of such work to the four branches above-mentioned, is organised under a general branch. This is the broad effect of the rearrangement as affecting the work to be done in particular branches. Every class of work has been carefully examined with a view to its allocation to the most suitable branch.

Heads of Branches.—The heads of branches should have a definite status in the department, and it is essential that they should be officers of ability, initiative, and experience. There being no intermediary between them and the chief officer, they should be officers upon whom the chief officer could place complete reliance, particularly as much of the work now carried out by the chief officer would devolve on them. They should have designations corresponding to their positions, and we propose the designations (i.) traffic manager, (ii.) electrical engineer, (iii.) rolling stock engineer, (iv.) permanent way engineer, (v.) chief clerk. Their remuneration should be commensurate with their position. In Part V. of this report we enter into detail as to salaries, but we desire to record our opinion that the salaries at present paid to certain heads of sections are inadequate.

It is important that the heads of branches should be relieved of work and responsibility which can safely be entrusted to subordinates so that, like the chief officer, they can give adequate time and attention to the more important aspects of their work. In this connection we have in mind the desirableness of the chief officer and the heads of branches keeping in close touch with tramway and transport work elsewhere than in London. Arrangements should be made for heads of branches to attend our meetings and the meetings of our sub-committees during the consideration of matters of importance affecting their branches, thus bringing us into closer touch with the officers immediately concerned in such matters. It has been pointed out to us that a considerable part of the time of the principal officers of the department is spent in preparing reports for committees. The attendance of the heads of branches at our meetings will increase the opportunities for information being given orally, whether on request or after notice. Reports are necessary, of course, in order to keep the Council informed and to maintain its records ; but the main duty of the higher officers is to secure, under the direction of the Council, the proper management and development of the undertaking. The preparation of reports must be subordinate to these considerations, and we feel sure that when normal conditions are resumed members will exercise forbearance, as they have done under war conditions, in their demand for reports on matters not of general interest.

Organisation of Branches.—The organisation of the branches is dealt with in detail in Part V. of this report. Some general considerations to which we have had regard should be mentioned here. In determining the salaries which should be assigned to the leading positions under heads of branches we have taken into consideration the responsibilities which will rest upon the officers in these positions owing to their executive duties under the arrangements specified below for relieving the chief officer of certain executive and other work. In advising as to the minimum and maximum salaries for the various positions, we think that the minimum salary should not necessarily be the commencing salary. We also propose, with a view to greater efficiency, that officers having the actual control of sections of work in a branch shall work immediately under the head of the branch, intermediary officers being eliminated.

4.—Arrangements for Relieving the Chief Officer.

Executive Work.—There is much departmental work carried out in accordance with the Council's standing orders and regulations, our rules and particular decisions of the Council and of ourselves. The most important points for departmental consideration and settlement in connection with this executive work must be reserved for the chief officer, whilst matters less important are decided by the heads of branches leaving minor matters to be settled by minor officials. (*Recommendation 1*—page 175.) There should be departmental records, brief and readily accessible, in form settled by the chief officer, of action taken by officers other than himself.

Engaging Employees.—Under the present system a very large percentage of persons taken into employment (other than officers appointed by resolution of the Council) have in practice been engaged

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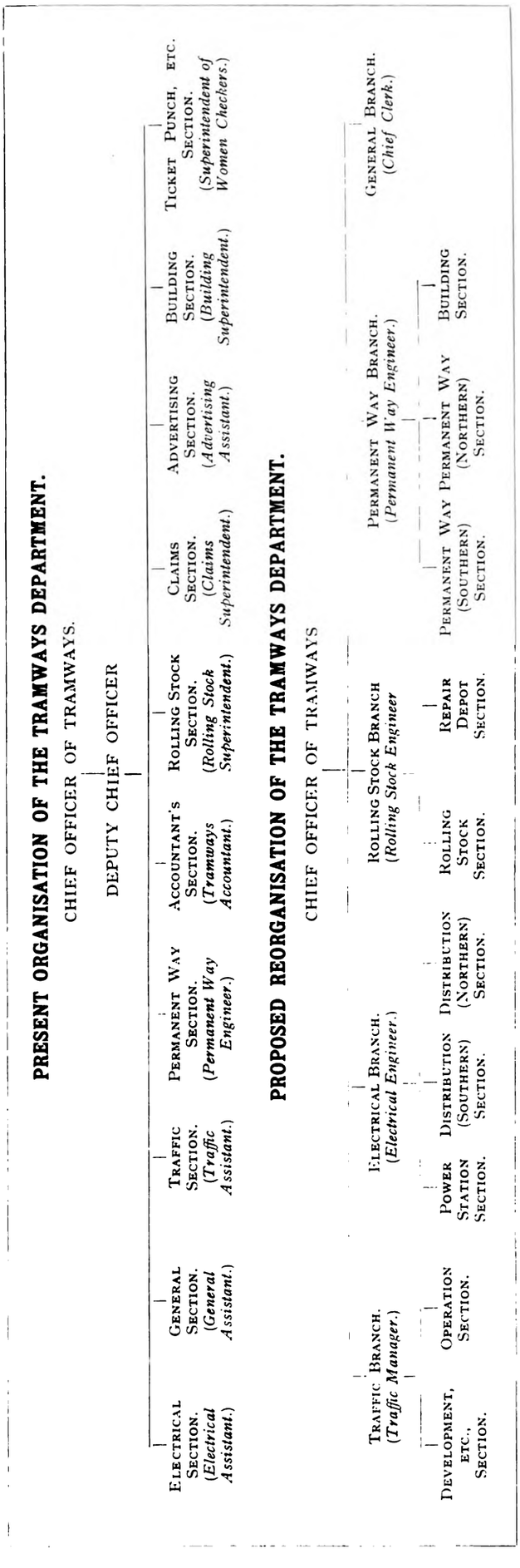
PRESENT ORGANISATION OF THE TRAMWAYS DEPARTMENT.
CHIEF OFFICER OF TRAMWAYS.
DEPUTY CHIEF OFFICER
Electrical Section. (Electrical Assistant.)
General Section. (General Assistant.)
Traffic Section. (Traffic Assistant.)
Permanent Way Section. (Permanent Way Engineer.)
Accountant's Section. (Tramways Accountant.)
Rolling Stock Section. (Rolling Stock Superintendent.)
Claims Section. (Claims Superintendent.)
Advertising Section. (Advertising Assistant.)
Building Section. (Building Superintendent.)
Ticket Punch, etc. Section. (Superintendent of Women Checkers.)
PROPOSED REORGANISATION OF THE TRAMWAYS DEPARTMENT.
CHIEF OFFICER OF TRAMWAYS
Traffic Branch. (Traffic Manager.)
Development, etc., Section.
Operation Section.
Electrical Branch. (Electrical Engineer.)
Power Station Section.
Distribution (Southern) Section.
Distribution (Northern) Section.
Rolling Stock Branch (Rolling Stock Engineer)
Rolling Stock Section.
Repair Depot Section.
Permanent Way Branch. (Permanent Way Engineer.)
Permanent Way (Southern) Section.
Permanent Way (Northern) Section.
Building Section.
General Branch. (Chief Clerk.)

by the deputy chief officer personally. Cases have been brought to our notice of men offering themselves for work at the place where work is being done and declining to undertake a journey to a distant office for the purpose of being engaged. This is a state of affairs which we cannot justify. We consider that the duty of engaging persons for employment could in a large proportion of cases and without disadvantage be entrusted, under rules made by us, to heads of branches and to officers occupying responsible positions below them. (*Recommendation t.*)

Disciplinary Matters.—Several officers in the department have a customary power of suspension of employees for a day or two. We think that the periods over which suspension may be ordered by officers of different status should be defined; and that, according to their status, officers of various grades having control of employees should have specified power to deal with disciplinary matters, subject to the individual affected having an indefeasible right of appeal to the chief officer personally. (*Recommendation s.*) There remains for consideration certain details in connection with disciplinary matters, e.g., the extent to which authority to dismiss employees should be delegated, and we shall report thereon at a later date.

Records of Service.—We consider that the heads of branches should keep the records of service of employees in their respective branches, except the records of service of officers appointed by resolution of the Council. (*Recommendation x.*)

Effect of Placing Responsibility on Subordinate Officers.—We are confident that arrangements on the lines above indicated will be of the greatest advantage to the service. The settlement of suitable matters by subordinate officers results in greater expedition, avoids the preparation of reports, and relieves superior officers of unnecessary work.

5.—Reports and Correspondence.

Annual Reports.—We suggest that officers having supervision of sections of the work of the department should submit each year to the heads of their respective branches brief reports on the work of their sections; and that the heads of branches should submit each year to the chief officer reports on the work of their respective branches; and that the chief officer should advert to such reports when submitting to us his annual report at the time of the submission of the annual accounts. (*Recommendations w.*)

In connection with this matter it remains for consideration whether the report of a superior officer should present *in extenso* the report of an inferior officer, or whether it should be in the discretion of the superior officer merely to quote from or refer to the report of the inferior officer.

Reports to the Committee.—We have considered whether it would be a relief to the chief officer and an advantage to the service if heads of branches, instead of the chief officer, signed departmental reports to us on routine matters. On the whole we think that the balance of convenience is in favour of the present system, under which all reports to us are signed by the chief officer. We consider, however, that where, in a matter which is the subject of report to us, there is a conflict of opinion on a technical or professional question between the chief officer and an officer occupying the position, as determined under the reorganisation scheme, of head of a technical or professional branch, the report to us should disclose the opinion of the head of the branch. (*Recommendation u.*)

Correspondence.—The correspondence of the department is of considerable volume. The chief officer personally signs the most important outgoing letters, the remainder being signed in his name by authorised officers. In connection with the work of each branch there is a good deal of correspondence on matters of detail not involving questions which should be brought to the personal attention of the chief officer. The electrical engineer, who resigned in 1910, customarily conducted such correspondence in his own name. The heads of the technical and professional branches should, we consider, be at liberty to conduct in their own names correspondence of this kind arising in their respective branches. We think also that this change is desirable as a recognition of the status of the heads of branches. We do not anticipate any difficulty in the definition of the correspondence thus to be left to the heads of branches, and this should, of course, be left to the discretion of the chief officer. (*Recommendation v.*)

(6) Store Purchase and Store Keeping.

We are making full inquiry into the present organisation of the work connected with the supply of stores required for the tramways department.

(7) Officers Appointed by Name by the Council.

In the present organisation certain positions in the department are filled by appointment by resolution of the Council, the remaining positions being filled by the chief officer. We are considering as to the extent to which positions in the department should be the subject of appointment by resolution of the Council.

(8) Financial and Accountancy Work.

We have given most careful consideration to the present position with regard to the financial and accountancy work in connection with the undertaking. This work forms part of the general financial and accountancy system for which the comptroller of the Council is primarily responsible, but a portion of the account keeping in detail is done by the staff of the tramways department.

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Functions of the Comptroller of the Council.—The comptroller of the Council, by standing order, is the financial adviser to the Council and all committees, including ourselves. In addition to the services which he renders to us in financial matters arising in current administration, he has rendered most valuable help to us whenever his advice has been sought on important questions involving financial considerations. He also reports to us from time to time on matters affecting the finances of the undertaking coming before him in the course of his duties. The reports of the comptroller of the Council have been of great assistance, and we desire to avail ourselves to the fullest extent of his services. Our rule, No. 128, provides that "in the case of all proposals brought before the committee which involve the submission of estimates, or otherwise deal with matters which have to come before the finance committee, the comptroller is to report at once to the Highways Committee with regard to any points relating to the financial bearings of the proposal." The duties of the comptroller of the Council in relation to us are, by standing order No. 421, of a wider character than those covered by the rule. We propose therefore an amendment of the rule to provide that in all matters affecting the finances of the tramways undertaking in which it is the duty of the comptroller of the Council, under standing order No. 421 or otherwise to advise us, he shall report thereon to us at the earliest convenient moment. In order to afford him all possible facilities in the discharge of his duties, we propose further that the rule shall provide that he shall be supplied as far as possible in advance with all information required by him for the purpose of any such report. We consider, however, that when he proposes to bring before us matters affecting the finances of the tramways undertaking and occurring to him in the course of his duties, he should acquaint the chief officer of his proposed action as far as it touches the management of the undertaking.

Accountancy Work of the Tramways Department.—The work of the tramways accountant may be divided into (1) work closely identified with the tramways organisation and the working of the undertaking, and (2) work comprising operations similar to those which in the case of other services are undertaken in the department of the comptroller of the Council.

The comptroller of the Council keeps the accounts of the undertaking, and the receipts and payments are made by him or under his general direction, but the work under (2) above has with his concurrence remained in the tramways department as a matter of administrative convenience, resulting partly from the staff arrangements of the several tramways undertakings acquired from time to time by the Council, and partly from the location of the tramways staff in various offices at some distance from the County Hall. This work in the tramways department is carried out in accordance with the rules of the Finance Committee, and falls within the purview of the comptroller of the Council in the course of his duties connected with internal audit and other matters.

We are of opinion that such accountancy work as is now performed in the tramways department should be merged in the general accountancy work of the Council; but that, owing to present difficulties, the transfer of the work from the tramways department to the department of the comptroller of the Council should not be effected immediately. Any convenient opportunity for transferring any part of the work should be taken, the general transfer being effected at the earliest convenient time. Pending the transfer certain modifications should be made in the present arrangements. The description "accountant's section" is misleading, and we consider that this should be altered to "accounts section." Similarly the nomenclature derived from company management of the various sub-sections should be altered. These questions of nomenclature are of departmental concern, and the deputy chief officer has informed us that the suggested alterations will be made. Care should be taken in the organisation of the sub-sections to keep accountancy work separate from administrative work, so that the ultimate transfer of this accountancy work to the department of the comptroller of the Council may be facilitated. Meanwhile it should be made clear that this work is subject to the general direction of the comptroller of the Council. (*Recommendation y.*)

V.—ORGANISATION OF THE BRANCHES.

As stated in Part II., section (3) of this report, we propose the reorganisation of the department into five branches, viz., (1) traffic branch, (2) electrical branch, (3) rolling stock branch, (4) permanent way branch, (5) general branch.

(1) Traffic Branch.

We have made exhaustive inquiry into the organisation dealing with traffic. Having regard to developments during the past few years in connection with passenger transport service in London, it is vitally necessary for a most efficient staff to be furnished to deal with traffic matters. The traffic problems which constantly confront us, and call for unremitting attention by the chief officer, cannot be dealt with adequately in the absence of an organisation specially designed for dealing with these matters in all their various aspects. Modern traffic conditions call for the application of scientific methods; and the organisation of a service such as that of the Council's tramways, operated under conditions not in their nature constant, should be sensitive to every change, actual or prospective, whether in relation to the requirements of the travelling public or to traffic conditions generally.

The traffic assistant and the officers under his directions, whilst fully occupied with essential duties, have been hampered in dealing with many classes of work which must be the subject of study in order to obtain and apply the knowledge necessary for the best results in connection with traffic organisation. Whilst fully appreciating the great services rendered by the chief officer and the deputy chief officer in connection with the work of the traffic section, we feel confident that a strengthening of the staff is essential to secure efficient handling of traffic, adequate dealing with traffic problems, and that internal impetus to efficiency and improvement which can be given only by a fully equipped staff constantly watching the interests of the undertaking and the requirements of the travelling public.

Traffic Manager.—The successful working of the undertaking must depend largely upon the organising capacity and proved ability of the officer in charge of the traffic. The number of employees in the section at the present time is over 5,000 and in normal times about 7,000, the salaries and wages paid in the branch at the present time amounting to about £11,000 a week. Having regard to the magnitude of the undertaking, the complexity of London traffic conditions, and the special circumstances arising in London on account of the existence of competitive services, a salary of only £600 a year cannot secure and retain in the Council's service an officer of the ability required. We consider that the change made in 1910, when the position of traffic manager was abolished and the smaller position of traffic assistant established, has not proved satisfactory, particularly in view of the alterations in traffic conditions in London since that time. We have no hesitation in advising that to the important position of traffic manager a salary of from £1,200 to £1,500 a year should be assigned. (*Recommendation b.*)

Work of the present Traffic Section.—The section is under the traffic assistant (position vacant), who has the supervision of the traffic arrangements and staff and matters pertaining generally to the section, including correspondence, making inquiries into complaints, irregularities, and delays, preparing reports, public and departmental notices, and instructions and rules for traffic staff. He also arranges special checks in connection with through running arrangements, etc., prepares traffic statistics, and controls the time-table staff and the arrangement of car services.

Next to the traffic assistant are two district superintendents, one for the northern and one for the southern section of the system; each section being divided amongst a number of divisional traffic superintendents, each of whom is an outdoor officer controlling the divisional inspectors, traffic regulators, and ticket inspectors assigned to his division and responsible for the efficient running of the car services therein.

After close inquiry into the work of the late traffic assistant and the two district traffic superintendents, we are satisfied that these officers, whilst rendering most zealous service have been compelled under pressure of circumstances to devote too much time and attention to matters of daily routine. Through want of staff capable of relieving them of such work, they have been unable to spend sufficient time on the road or to compile and study returns of traffic with a view to its improvement.

We have arrived at the conclusion that the work of the traffic branch should be organised in two sections, viz., (1) a development and pulicity section, to deal, as outlined below, with matters which have not hitherto received adequate attention; and (2) an operation section.

Development and Publicity Section.—The requirements of the public and the possibilities of the tramways undergo constant change, owing to growth and migration of population, growth and decadence of shopping and industrial centres, and other causes of alteration in the flow of passenger traffic. All such changes require to be catered for and, if possible, anticipated, and it will be a primary duty of this section to obtain the necessary data on which action should be based. Moreover, the London tramways have to compete for traffic with other means of transit, and the development of the undertaking on successful lines must to a considerable extent depend on constant and well-directed effort to adjust the services to public needs. Such matters as through running, through booking, interconnection with other undertakings, nature and adequacy of services, fares and fare stages should be dealt with in this section as matters of development.

We attach equal importance to the publicity work which we propose should be undertaken in this section. In 1913 a firm of advertising contractors offered to advertise the Council's tramways at a cost of £23,150 a year; and in the following year an advertising scheme involving expenditure of about £6,000 a year was submitted by another firm. These offers were not accepted. The chief officer is of opinion that to advertise adequately the Council's tramways would involve expenditure of £15,000 to £20,000 a year. Whilst not wishing to prejudge the question of the amount which should properly be appropriated for publicity service, we are satisfied that, apart from other forms of publicity, greater use should be made of the Press as a means of conveying to the public advantages peculiar to the tramways service. Newspaper articles should be encouraged and suitable matter prepared; new and altered services should be

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advertised in the Press; and attractive tramway maps and guides should be distributed.

The preparation of time tables should be undertaken in this section, which should also carry out independent traffic checks. To enable the preparation of time tables to be undertaken scientifically and with the fullest regard for the requirements of the public and the possibilities of the service, the head of this section should be furnished by the head of the operation section with all traffic data and statistical information required for the purpose and obtainable in that section.

The principal officer in this section should be directly responsible to the traffic manager, and be designated the development superintendent, the salary to be assigned to the position being from £500 to £800 a year. He should have under him at least three responsible heads of sub-sections :—(i.) a publicity assistant (from (£300 to £400 a year), (ii.) an officer in charge of matters relating to fares and independent traffic check—designation to be determined—(from £300 to £400 a year), and (iii.) a time table assistant (from £250 to £300 a year). (*Recommendation j.*)

Operation Section.—The other section of the traffic branch, under the immediate and close supervision of the traffic manager, would be in effect the present traffic section. The section requires reorganisation for the purpose of focussing its energies on the work of traffic operation, and economising the time of the principal officers, so that they may give adequate attention to such important matters as obtaining and utilising, by and through subordinates or otherwise, statistical and other information likely to assist in securing the most satisfactory results in connection with traffic operation. This result, as regards relieving the principal officers, will be secured by detailing clerical and other assistance. There should be a smooth channel of communication from this section to the development and publicity section of statistics and information, and ready and sympathetic consideration of suggestions made by junior grades of traffic officers and others.

The principal officer in this section should be directly responsible to the traffic manager and be designated operation superintendent, the salary to be assigned to the position being from £500 to £700 a year. His position would correspond approximately to that of traffic assistant in the present organisation. (*Recommendation k.*) The designation of the two district superintendents should be altered to divisional superintendents, with approximately similar duties, the salary to be assigned to each position being from £300 to £400 a year. (*Recommendation l.*) The divisional traffic superintendents below them, on outdoor work, in the present organisation should be designated district superintendents. This grade was introduced as recently as 1914, and we are satisfied that the appointment of these officers has had useful results as regards improvement in car services and control of the work of operation. Their rate of pay should now be fixed. (*Recommendation aa.*)

The supervision of the work of the punch repair shop should be placed under the divisional superintendent (southern section). The depot staff engaged in issuing tickets to and receiving money from conductors should be retained in this section. The remaining operations in connection with the ticket checking, cash counting and distributing, at present undertaken in other sections, should be allocated under present conditions to the general branch.

(2) Electrical Branch.

Electrical Engineer.—The officer in charge of the electrical work has charge of the power supply and distribution, supervises the running of the Greenwich power station and the sub-stations, the maintenance and renewal of the plant and machinery at these stations, and the electrical equipment of conduit and overhead lines. He also has general charge of all electrical matters connected with the undertaking. The number of employees in the branch at the present time is over 600, and in normal times over 700; and the salaries and wages paid in the branch at the present time amount to about £1,500 a week. The value of plant and machinery under his charge may be estimated roughly at £750,000, the annual expenditure on revenue account under his direction being approximately £300,000.

Since April, 1914, the Council has paid a retaining fee of £500 a year to consulting electrical engineers, such fee covering all references, reports, and consultations in connection with the electrical engineering of the tramways undertaking. In the case of new constructive work, a commission is paid to the consulting engineers on the certified cost of plant.

Up to 1910 the head of the electrical section was designated electrical engineer, his salary being £1,200 a year; but upon his resignation an electrical assistant (£800 a year) was placed in charge of the electrical work. We are strongly of opinion that the position of electrical engineer should be reverted to and that the salary to be assigned thereto should be from £1,200 to £1,500 a year. A lower scale of salary is in our judgment inadequate for an officer competent to have charge of the whole of the electrical work of the undertaking, including responsibility for the safe and efficient working of the extensive, costly, and delicate plant and machinery at the power station and sub-stations, and to advise on the many important matters arising in connection with the electrical work. Our special sub-committee, which inquired into staff matters affecting the electrical section, communicated to us on April 22, 1915, their opinion arrived at in February, 1914, that an electrical engineer should be appointed, on a vacancy occurring (as it has since done) in the position of electrical assistant, and that the salary should be from £1,200 to £1,500 a year. (*Recommendation e.*)

The electrical engineer should assist in the work of drawing up specifications for the supply of electrical material for the rolling stock section.

Upon the appointment of an electrical engineer, the present arrangements with regard to the services of consulting engineers can be reconsidered; and whilst we should not advise excluding the services of outside engineers in matters of the greatest importance, a more economical arrangement than that at present obtaining could no doubt be made.

Assistant to the Electrical Engineer.—The question of the appointment of an assistant to the electrical engineer, to take charge of the branch in his absence, should be deferred until the electrical engineer takes up his duties.

The work of the electrical branch should be organised broadly on the basis of the organisation of the present electrical section. The branch should be divided into three sections, viz., (1) the power station section, (2) the distribution (southern) section, and (3) the distribution (northern) section.

Power Station Section.—The designation of the superintendent of the Greenwich generating station should be altered to power station engineer. He would be the principal officer in this section, and we consider that the salary to be assigned to the position should be from £500 to £700 a year. (*Recommendation m.*)

Distribution (Southern) Section.—The designation of the resident electrical superintendent (southern section), the principal officer in this section, should be altered to distribution engineer (southern section), and the salary to be assigned to the position should be from £400 to £600 a year. (*Recommendation m.*)

Distribution (Northern) Section.—The designation of the resident electrical superintendent (northern section), the principal officer in this section, should be altered to distribution engineer (northern section), and the salary to be assigned to the position should be from £400 to £600 a year. (*Recommendation m.*)

On a vacancy occurring in either of the positions of distribution engineer, consideration should be given to the desirableness of placing distribution work under one officer. (*Recommendation n.*)

The sub-committee have expressed their appreciation, which we fully share, of the valuable assistance given to them in their consideration of questions arising in connection with the electrical work of the department by Mr. J. H. Rider, formerly electrical engineer in the department, whose advice in many important matters greatly facilitated their work.

(3) Rolling Stock Branch.

Rolling Stock Engineer.—The officer in charge of the rolling stock branch, which will remain practically unchanged as regards the scope of its activities, supervises the maintenance, washing, repair, and renewal of all cars and other vehicles operated by the department and the upkeep of the central car repair depot, and other depots. He reports on matters connected with rolling stock and staff, prepares estimates, etc., for new plant and machinery, new rolling stock, stores, and replace parts for rolling stock, undertakes testing during manufacture, designs special machine tools and other plant, and gives evidence before the Courts in connection with claims for damage and accidents. The number of employees in the branch at the present time is approximately 2,200, and in normal times nearly 3,000, the salaries and wages paid in the branch at the present time amounting to over £4,000 a week. The expenditure on revenue account in respect of the work of the branch is about £325,000 a year.

The general considerations already urged as to the inadequacy of the salaries assigned to some of the positions at the head of sections applies to the position of head of this branch. To obtain and retain the services of an engineer competent to be in charge of the important work of the rolling stock branch, an adequate salary must be paid; and we consider that the salary to be assigned to the position should be from £1,000 to £1,200 a year. (*Recommendation f.*)

The work of the rolling stock branch should be divided under two main sections, viz., (1) rolling stock section, and (2) repair depot section.

Rolling Stock Section.—The officer in charge of this section should be designated rolling stock superintendent and should be directly responsible to the rolling stock engineer. The duties of the rolling stock superintendent should consist of taking charge of the car depots and rolling stock, supervising all running shed staffs and running repairs and cleaning of cars, and keeping all records in connection with car shed operations. The cartage work should also be under the direction of the rolling stock superintendent. We consider that the salary to be assigned to the position of rolling stock superintendent should be from £400 to £600 a year. (*Recommendation o.*)

Technical Assistants.—Two technical assistants engaged in the supervision of car depots should be attached to the rolling stock superintendent as personal staff, so that there may be no intermediary officers with executive functions between him and the foremen of car depots.

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Foremen of Car Depots.—There are about 70 foremen and intermediate foremen of car depots, with rates of pay ranging from 50s. to 80s. a week. We think it desirable to simplify the classification of foremen. The number of classes should be reduced, and the minimum pay of a higher class should not be less than the maximum pay of a lower class. (*Recommendation z.*)

Cartage Work.—The supervision of this work is now being performed by the former horse superintendent at a salary of £250 a year. The question of the salary to be paid to the officer primarily in charge of cartage work will be reconsidered when the position next becomes vacant.

Repair Depot Section.—The officer in charge of this section should be designated superintendent of the central car repair depot and should be directly responsible to the rolling stock engineer. The superintendent is responsible for the supervision of the depot and for certain repair work temporarily carried out at subsidiary depots pending a connection, available for double-deck cars, between the northern and southern sections of the system. In normal times the work consists of the annual overhaul and renovation of the whole of the tramways rolling stock; the repair and maintenance of motor vehicles; the manufacture of certain parts of rolling stock equipment; checking of time sheets and similar records and the keeping of records of shop costs. We consider that the salary to be assigned to the position of superintendent of the central car repair depot should be from £400 to £600 a year. (*Recommendation o.*)

An officer of superior standing at the central car repair depot should reside at or near the depot.

(4) Permanent Way Branch.

Permanent Way Engineer.—The permanent way engineer supervises the repair and renewal of all the track on the 147 street miles of tramway operated by the Council, the installation, maintenance, and renewal of the tracks in the depots; and the permanent way yards, depots and repair shops. The number of employees in the branch on permanent way work at the present time is about 800 compared with 1,400 at normal times, the salaries and wages paid in the branch when working under normal conditions exceeding £2,000 a week. In a normal year the expenditure on revenue account in respect of work undertaken to the permanent way amounts to about £240,000.

We propose, having regard to the qualifications and experience which should be regarded as necessary, that the salary to be assigned to the position of permanent way engineer should be from £800 to £1,000 a year. We think, however, that whilst making provision in the ultimate organisation for such a position, it should not be filled at present. (*Recommendation h.*)

The main organisation of the present permanent way section should be preserved in the permanent way branch. To this branch should be transferred the work of the present building section, and also work connected with the conduits, at present undertaken in the electrical section. The branch should accordingly be divided into three sections, viz., (1) permanent way (southern) section; (2) permanent way (northern) section; and (3) building section.

Permanent Way Sections.—Each of the permanent way sections (southern and northern) should remain, as heretofore, under the direction of an assistant permanent way engineer, each under the immediate supervision of the permanent way engineer. The scale of salary for the position of assistant permanent way engineer should in each case be from £300 to £400 a year. (*Recommendation p.*)

Building Section.—The nature of the work undertaken in the present building section is indicated in Part II. of this report. The number of employees in normal times exceeds 100, the value of work carried out being about £13,000 a year. We have considered whether any other arrangements for the execution of the work would be more satisfactory. The possible arrangements are (1) to place the work with jobbing contractors; (2) to merge the work with similar work carried out by the architect by direct employment of labour in connection with the maintenance of school buildings, etc.; (3) to distribute the staff of the section amongst the various branches of the tramways department with a view to the head of each branch becoming responsible for minor works and repairs to property held for the purposes of the branch; or (4) to adhere to the present system of centralisation in the department of repair work, etc., to buildings held in connection with the tramways undertaking. After carefully reviewing the relative advantages and disadvantages of the various possible arrangements for this work, we are satisfied that under present conditions the system now in operation should be adhered to. The building section can most conveniently be placed in the permanent way branch; and the building superintendent, the principal officer in the section, should be under the immediate supervision of the permanent way engineer.

(5) General Branch.

The department work not allocated to the four main branches already discussed can be organised conveniently in a general branch. The head of this branch, for whom we suggest the designation of chief clerk, would undertake the duties hitherto falling to the general assistant and would also, in present circumstances, supervise sections dealing with accounts, stores, ticket checking, claims, and printing. We propose that the clerical staff working in all branches of the department shall, for purposes of discipline and promotion, be dealt with as part of the general branch. We also propose that the drawing office staff shall be distributed amongst the various technical and professional branches; and that a technical assistant in the first class, who has acted as a personal assistant to the chief officer, be excluded from branch classification and attached as personal assistant to the chief officer.

The arrangement under which Messrs. W. H. Smith and Son act as sole agents of the Council for obtaining advertisements on the Council's cars (see Part II., section (8) of this report) renders unnecessary the present advertising section of the department. We accordingly recommend the abolition of the position of advertising assistant. The departmental work in this connection would be done in the general branch. (*Recommendation q.*)

We have to refer to three classes of work which cannot be regarded as permanently allocated to the general branch, the question of the ultimate destination of the work, or the date of its transfer from the department, remaining undecided for the present.

(1) *Accounts Work.*—In Part IV. of this report, under the heading "Financial and accountancy work," we have stated our views as to the ultimate transfer to the department of the comptroller of the Council of the accountancy work now undertaken in the tramways department. Pending such transfer, the work should be carried out in an accounts section of the general branch by the tramways accountant, and subject to the general direction of the comptroller of the Council.

(2) *Store Purchase and Store Keeping.*—In Part IV. of this report we have stated that our inquiry into the present organisation of the work connected with the supply of stores for the tramways department is still in progress. Subject to any change which may result from this inquiry, the present stores branch of the accountant's section should be a separate section in the general branch.

(3) *Cash Counting, Ticket Checking, etc.*—The tramways accountant has supervision of certain work, connected with cash counting and distributing, which it is not at present proposed to remove from the tramways department upon the transfer of accountancy work to the department of the comptroller of the Council. We propose the allocation to the general branch of the work of ticket checking at present undertaken in a separate section. Care will be taken that the officers engaged upon the separate operations of cash counting and distributing, and ticket checking, act independently of one another, Subject to this we consider that the work connected with these separate operations may be carried out in the general branch under present conditions, but the desirableness of other arrangements being made at a more convenient time will be borne in mind.

In view of the uncertainty as to the amount of work to be regarded as permanently allocated to the general branch, and the temporary arrangements with regard to accounts work, the organisation of the branch must be regarded as provisional.

Chief Clerk.—For the reasons just mentioned the question of the scale of salary to be attached to the position of chief clerk should remain open for the present.

VI.—NEED FOR IMMEDIATE ACTION.

In the interests of the service we think that the reorganisation scheme should be brought into practical working at the earliest date. So far as the present staff is concerned, there is nothing to prevent the immediate reorganisation into five branches, and the definite settlement of relative positions of officers therein. Our immediate proposals for filling certain higher positions are the subject of a separate report.

VII.—FINANCIAL EFFECT OF REORGANISATION.

The ultimate additional expenditure of reorganisation in respect of the appointments and promotions provided for under our scheme will be £5,600 a year. Beyond this figure there may be some additional expenditure resulting from the settlement of the salary of the chief clerk. Further, when the development section of the traffic branch is formed, in addition to the new positions provided for in the scheme, additional staff will be required, and will probably be furnished in the first instance by transfers within the department. The work of the section will involve fresh charges on revenue account; for example, expenditure, referred to in Part V. above, on advertising the tramways. No expenditure, however, on such an object can be incurred without the express sanction of the Council.

Having regard to present conditions, it has been our object to determine the reorganisation on a basis involving the smallest increase of expenditure compatible with efficiency. This will be at once apparent if the figure of £5,600—the ultimate additional yearly expenditure on higher staffing—is considered in relation to the annual expenditure (£1,102,218 in 1913-14) on salaries and wages in the tramways department. We feel confident that any expenditure incurred by the Council in giving effect to the proposals in this report will be rapidly recouped as a result of improved organisation and working. We have, indeed, no doubt that the proposed additional expenditure will be highly remunerative, owing to the great extent to which the successful management of an undertaking such as that of the Council's tramways is dependent upon the effective organisation and adequate staffing.

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We have communicated our proposals to the General Purposes Committee and also to the Finance Committee. Certain of our proposals should be the subject of regulations of the Council, and the General Purposes Committee will in due course submit the necessary recommendations.

VIII.—RECOMMENDATIONS.

We recommend :—

(*a*) That the tramways department be reorganised on the basis of the allocation of the work of the department amongst five branches, viz., (1) traffic branch, (2) electrical branch, (3) rolling stock branch, (4) permanent way branch, (5) general branch, and the devolution by the chief officer of tramways of duties and responsibilities to the higher subordinate officers upon general lines.

(*b*) That a traffic manager be appointed in the tramways department, and that the salary assigned to the position be from £1,200 by annual increments of £50 to £1,500 a year.

(*c*) That on a vacancy occurring in the position of deputy chief officer of tramways, the position be abolished.

(*d*) That the position, now vacant, of electrical assistant be abolished.

(*e*) That an electrical engineer be appointed in the tramways department, and that the salary assigned to the position be from £1,200 by annual increments of £50 to £1,500 a year.

(*f*) That a rolling stock engineer be appointed in the tramways department, that the salary assigned to the position be from £1,000 by annual increments of £50 to £1,200, and that the position be not filled at present.

(*g*) That on the appointment of a rolling stock engineer the present position of rolling stock superintendent be abolished.

(*h*) That in the ultimate organisation the salary assigned to the position of permanent way engineer in the tramways department be from £800 by annual increments of £50 to £1,000 a year.

(*i*) That a chief clerk be appointed in the tramways department.

(*j*) That positions as follows be established in the traffic branch at the yearly salaries specified :—

Development superintendent (from £500 by four annual increments of £25 and four of £50 to £800 a year) ;

Publicity assistant (from £300 by annual increments of £25 to £400 a year) ;

An officer in charge of matters relating to fares and independent traffic check (designation to be determined, from £300 by annual increments of £25 to £400 a year) ;

Time tables assistant (from £250 by annual increments of £12 10s. to £300 a year).

(*k*) That an operation superintendent (from £500 by four annual increments of £25 and two of £50 to £700 a year) be appointed in the traffic branch, and that the position of traffic assistant be abolished.

(*l*) That the designation of the two district traffic superintendents be altered to divisional superintendents ; and that the salary assigned to each position in the ultimate organisation be from £300 by annual increments of £25 to £400 a year.

(*m*) That the designation of certain positions in the electrical branch be altered, and salaries for the positions in the ultimate organisation assigned as follows :—

Power station engineer (from £500 by four annual increments of £25 and two of £50 to £700 a year) (present designation, superintendent of Greenwich generating station).

Distribution engineer, southern section (from £400 by annual increments of £25 to £600 a year) (present designation, resident electrical superintendent, southern section).

Distribution engineer, northern section (from £400 by annual increments of £25 to £600 a year) (present designation, resident electrical superintendent, northern section).

(*n*) That on a vacancy occurring in either of the positions of distribution engineer the Highways Committee do consider as to the desirableness of placing distribution work under one officer.

(*o*) That upon an appointment being made to the position of rolling stock engineer the position of assistant rolling stock superintendent be abolished, a position of rolling stock superintendent (from £400 by annual increments of £25 to £600 a year) established, and a salary of £400 by annual increments of £25 to £600 a year assigned to the position of superintendent of the central car repair depot.

(*p*) That in the ultimate organisation the salary assigned to each of the two positions of assistant permanent way engineer be from £300 by annual increments of £25 to £400 a year.

(*q*) That the position of advertising assistant be abolished.

(*r*) That an assistant in the first class be attached as a personal assistant to the chief officer of tramways.

(*s*) That any officer or employee in the tramways department affected by the decision of an officer in that department, other than the chief officer of tramways, in a matter of discipline, do have the right of appeal to the chief officer personally.

(*t*) That the heads of branches in the tramways department, and certain officers acting under them, be responsible for the carrying out of such duties in connection with executive work, the engagement of staff, and disciplinary matters, as may be assigned to them by the chief officer of tramways and in accordance with rules of the Highways Committee.

(*u*) That where, in the matter which is the subject of report to the Highways Committee, there is a conflict of opinion on a technical or professional question between the chief officer of tramways and an officer occupying the position, as determined under the reorganisation scheme, of head of a technical or professional branch of the tramways department, the report to the committee shall disclose the opinion of the head of the branch.

(*v*) That the heads of branches in the tramways department be permitted to carry on in their own names correspondence of a routine character not requiring the personal attention of the chief officer of tramways, provided that such correspondence shall be subject to the direction of the chief officer.

(*w*) That officers having the supervision of sections of the work of the tramways department to submit each year to the heads of their respective branches brief reports on the work of their sections ; that the heads of the branches do submit each year to the chief officer of the tramways reports on the work of their respective branches ; and that the chief officer do advert to such reports when submitting to the committee his annual report at the time of the submission of the annual accounts.

(*x*) That the heads of the branches in the tramways department do keep the records of service of the employees in their respective branches, except the records of service of officers appointed by resolution of the Council.

(*y*) That at the earliest convenient time that part of the accountancy work which is now done in the tramways department be transferred to the department of the comptroller of the Council, and that pending such transfer the work do continue to be done in the tramways department, subject to the general direction of the comptroller of the Council.

(*z*) That the weekly rates of pay of day foremen, night foremen, and intermediate foremen of car depots in the tramways department be as follows :—

Class of Depot.	Approximate Weekly Car Service.	Day Foremen.	Night Foremen.	Intermediate Foremen.
		£ s. d. £ s. d.	£ s. d. £ s. d.	£ s. d. £ s. d.
A	900 and upwards	3 12 6 to 4 0 0	3 7 6 to 3 12 6	3 0 0 to 3 5 0
B	450 to 900 ...	3 5 0 „ 3 10 0	3 2 6 „ 3 5 0	2 17 6 „ 3 0 0
C	Up to 450 ...	3 0 0 „ 3 2 6	2 17 6 „ 3 0 0	2 12 6 „ 2 15 0

and that where a house is provided the value thereof be calculated at 5s. a week, and reckoned on that basis as part wages.

(*aa*) That the rate of pay of district superintendents in the traffic branch of the tramways department be from 60s. to 90s. a week.

G. H. HUME,
Chairman.

COMMITTEE EMPOWERED TO OFFER MAXIMUM SALARIES.

In the course of the discussion in the Council, Mr. H. H. GORDON (deputy chairman) said the success of the scheme would depend on two factors ; first, obtaining the right men to fill the five higher positions contemplated and also the important minor positions that were to be created. He suggested that the committee should be given a free hand to attach the maximum salaries to the posts. Even if they got the best men it was impossible by a stroke of the pen to be able to effect immediate reform of the undertaking. The conditions were anomalous, and the system had grown at such a pace that with a depleted staff and carrying three-quarters of the passengers of the metropolitan area the task was one of gigantic magnitude.

Mr. G. HARDY doubted whether the salaries offered would attract the best men. The time was not opportune, but there was need for the reorganisation of the whole traffic problem and the removal of the overlapping to be found in many districts. There ought to be a scheme to co-ordinate the traffic of London.

Mr. H. E. COTTON hoped that the committee would lend their energies to getting rid of the local opposition to extending the tramways to points where people wanted to travel.

Mr. W. J. SQUIRES (ex-chairman of the Highways Committee) agreed that success was bound up with the linking-up policy, and pointed out that several such extensions had been stopped by the war. The Council would welcome Mr. Fell back to his office, for with his assistance he believed that the new scheme would produce good results.

Mr. T. F. HOBSON, a member of the sub-committee, reminded the Council that such questions as linking-up and London traffic reorganisation were outside the terms of reference. Under the recommendations of the report a great deal could be done that was essential to an efficient service. Three of the most important offices were vacant.

Mr. G. H. HUME, chairman of the Highways Committee, said the scheme might not settle everything, but it would go a long way to meet the new peace conditions. He accepted amendments proposed by Mr. Gordon to give the committee free action in regard to making appointments at the maximum instead of minimum salaries if necessary.

The recommendations, as so amended, were then agreed to.

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NEWCASTLE CORPORATION TRAMWAYS.

A FINE WAR RECORD.

Councillor R. Mayne, chairman of the Newcastle Corporation Tramways Committee, was the guest recently of the local Rotary Club, and gave a capital address on the work of the tramways during the war. He described in a convincing way the difficulties that have been surmounted, and showed how satisfactory is the position of the undertaking at the present time. Mr. Mayne has been identified with public work in Newcastle for many years, and has long been an influential member of the Tramways Committee. First as vice-chairman, and for the past few years as chairman, he has helped to guide the undertaking through many difficult situations. In view of the abnormal conditions that have been so successfully met by the management, Mr. Mayne's paper will be read by all interested in tramways both at home and overseas, and we give it in full below.

There are 69 miles of single track on the Newcastle tramway system, most of it laid down at an expensive period in an expensive manner, but with thoroughness and completeness. An advantage of the system is that no one in Newcastle need walk for over five minutes to reach a tramway line. This, of course, involved great capital cost, but it is a capital convenience.

The capital cost of the system has been £1,355,846, but of that sum over £550,000 has been repaid out of tramway profits. While the system has always been profitable, there have been times when drastic changes have alone prevented it becoming the reverse. The turnover, judged by the number of passengers carried, has been a continuously increasing one—in the past two years almost overwhelmingly so—but the costs have been just as abnormal, and each penny fare now bears a smaller percentage of profit. It does not follow that an increased turnover in these times means an increase of profit, especially when the goods are sold at the old price though costing the new price. The gross profits, however, have kept well up, being for last year £135,765, as against £95,000 five years ago, or a present profit on capital invested of 10·24 per cent. After repaying annual redemption, interest, and other charges there was a surplus available of £58,122, as against £26,341 five years ago. Out of this surplus was paid the income-tax, which amounted to £10,834, as against £2,637 five years before; £13,144 was given in allowances to the men who had volunteered for active service; £2,000 was placed to an insurance fund which we proposed to build up on our own account; £8,164 was given to the reduction of rates, and the balance was paid to the reserve fund.

It is more necessary than ever that this reserve fund should be of a substantial amount, and there is no doubt that by the end of March this year it can be £100,000, a figure at which it should be kept, for repairs and renewals are only now being deferred through want of labour and material. Whilst five years ago our total traffic receipts were just on £200,000, last year they amounted to £314,732, and this year I anticipate will show them to be well up to £340,000, but to set against that our working expenses, which in 1911 (five years ago) were £113,973, and in the year before the war were £147,552, last year had risen to £192,648, the chief increase being in wages, whilst, of course, materials have gone up in price enormously. I would like here to pay tribute to the foresight of our general manager, Mr. Hatton, who in the early difficult days laid in store mechanical parts which, if they had to be bought now, would cost five or six times the price, and even at the high price some systems are unable to get delivery.

Increase of Traffic and Staff Difficulties.

There has been an almost overwhelming increase of traffic. Five years ago we carried 45 millions of passengers. In the year prior to the war the number had increased to 58 millions, and by the end of this year, March 31, we will have carried 78 millions. That meant 20 millions more passengers carried with the same number of cars, running 1¼ million more miles, with an experienced staff so largely replaced by newly-trained men and women. Many of them were taught, and then, before their experience made them what might be called skilled drivers, they in turn were called up, so that the staff has been continually changing. When war broke out we had a total staff of 609 motormen and conductors, with 120 male "cleaners," who were taught to drive and were always there to take the place of a late or absent man.

To-day the staff numbers 739, which includes 320 women conductors and a number of auxiliary drivers who give what time they can spare, chiefly in the early morning. But in the meanwhile we have trained or taught in our school and on the cars no less than 1,883 motormen and conductors—continually training, continually losing for the nation's needs.

Women Conductors and Inspectors.

I suppose the greatest innovation of the time has been the introduction of women to the service as conductors, and, quite recently, as ticket inspectors. While we know the faults of many of them—the lack of concentration, the difficulty many of them seemed to have in realising that it was a business they were engaged in and not a period of joy riding—they have saved the situation. It must not be forgotten that the women are faced with crowded conditions that the male conductor of pre-war times never had to tackle.

In 1914 they had 130 "male cleaners," all trained to drive a car when need occurred. Now they have been replaced by women, who, while they do that work well, are yet unable to take the place of absentee drivers; and we have late and absent men and women daily. As many as 18 cars have at times stood idle because of this; but owing to the weather for the past two months, and the exposure and discomfort of the "man at the front" being so severe, some proportion are bound to succumb. The pre-war men on our staff who were beyond military age have been the backbone of the service, and have done splendidly.

Every Available Car for Munition Workers.

When the sudden rush of traffic for munition workers came upon us we felt, first thing being placed first, that all we could do would be done to carry them to their work; so instead of running 95 cars in the early morning, we put out every available car every morning, and have continued to run an average of 174 cars. What are other towns doing to compare with this? In Manchester, where they run 580 cars between 8 and 10 a.m., they run 144 in the early morning. In Liverpool 500 between 8 and 10, and 160 between 5 and 6; in Leeds 233 between 8 and 10, and 162 between 5 and 6.

Auxiliary Motormen.

We could never have done so much but for the valuable help of what we call auxiliary motormen. These are men who for various reasons have not been called to don the khaki—men mostly in business or professions who practically have "done their bit," and a very useful bit, by rising in the mornings at 4.30 and taking out workmen's cars. We are still likely to have to a greater degree the need for auxiliary drivers. There are a good many men yet over military age whose hours at business would permit them to take up the work. A difficulty we find is to get men who can get the time in daylight to spare over their training. In the Council some time ago I ventured the opinion that many ministers in the city who are exempt from military service might take this work on. My suggestion does not seem to have been taken seriously—at least, none have volunteered. I meant it!

I need not dwell on the obvious disadvantages the staff have laboured under through the lighting restrictions. There is much we cannot see as a result of these. But the disadvantages are quite obvious. To the thoughtful driver every shadow seems a reality, and unfortunately the seeming shadows are at times realities.

Justifiable Overcrowding.

Do you remember how on the outbreak of war there were many who urged that employment should be found for the numbers likely to be unemployed? The Council hurriedly passed certain schemes to that end. Now we realise better how difficult it was for anyone to foresee the local effects of a great war, but very early we endeavoured to buy more cars—second-hand ones if we could. None, however, could be obtained, and we have no more cars than we had in July, 1914. Yet I offer the assurance that, after the munitions workers' service, all routes are served proportionately as their needs are indicated by the traffic. Threats have been made to bring legal action to prevent overcrowding. Well, what good would that do? We have the legal right to charge one penny per mile, and we would need to considering present costs; but would it be any better for the threatener to stand, for instance, in Northumberland Street until he could get a seat for threepence than to be standing in a tramcar travelling home for twopence, always with even chances of a seat?

The Committee's Clear Conscience.

We shall go on doing our best, knowing, in face of "the realities," how little it matters that grumbling exists. As a committee we are conscience clear, and when again we get into peaceful times there will be a good reserve fund built up to meet the heavy repairs which have been deferred. We shall begin to find the advantage of loans falling in, with consequent saving of interest payable to those from whom we had the loan. The first falls in this ensuing year; £550,000 has been repaid off capital cost; there is £100,000 reserve fund; and the ratepayers have received at various times £74,000 towards reductions of rates. The system as a going concern is to-day better in value than ever it was, so that in fifteen years Newcastle has gained £724,000 from its cars.

Traffic Congestion in New York.—New York City Railways, in a new illustrated bulletin entitled "New York Railway Service," dated January 29, describe the crisis in street congestion in New York City. This is characterised by serious blockades from building operations, subway construction, sewer and water main excavation and repaving, by a grave shortage in the Street Cleaning Department's snow fighting forces and by an enormous increase in the number of automobiles. As relief measures which would help the situation, the bulletin suggests that vehicles be not allowed to stand along the kerb of certain designated streets, that traffic officers co-operate closer at certain localities in regulating traffic, and that certain cross-town streets be limited to one-way traffic during rush hours.

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TWO DUDLEY ACCIDENTS.

Failure of the Human Element.

The Dudley Coroner, on February 7, concluded his investigation of the circumstances attending the death of a young woman who was killed by the overturning of a car on which she was journeying to take up duty as a learner-conductor on January 4. The car arrived at the Dudley terminus at 7.6 a.m., when the driver applied the hand brake, passed through the car, and took the reversing key with him to the mess-room. The brake so applied would hold the car though it were on a slope. The car was started on its next journey without the inspector seeing it, and before the driver had returned. The inspector was paying attention to other cars, this one being due to start at 7.12, and the inspector having told the driver to await the arrival of the Stourbridge-Dudley car. The car attained great speed, and at the first turnout jumped the points, ran along the track for 15 yards and fell over on to the right-hand side of the road. It was the same car that ran away a year ago at this place and overturned, causing one death. One of the witnesses at the present inquiry was a passenger, who said that either himself or someone in front of him in boarding the car put his foot on the foot gong, causing it to ring. Another witness said the deceased was standing on the platform with the woman conductor, who asked deceased if the driver had rung. Deceased replied, "Yes, he has rung twice, and I rung after him." The conductor then rang twice, and released the brake.

The motorman's evidence showed that he had been a driver for 15½ years. In reply to the Coroner, he stated that when starting from the terminus he had to ring twice to the conductor and she would ring two back again and release the brake. The Coroner: You tell the jury that the first bell is given by the driver? Yes, sir.—According to your rules the conductor is the first to ring two bells to you—it used to be one bell, but since the last accident it was altered. Do you want to qualify that?—I will qualify it to the right way about. Witness explained that the women conductors got the drivers to ring first because they carried no watches and did not know the time.—So you make rules to suit yourself? No, sir.

The conductor stated that deceased told her the driver had given two rings, so witness rang back twice and released the brake. She did not get two bells back from the driver. She knew of the rule which said that the conductor was to see that the driver was on the car before releasing the brake. She forgot to carry out that rule. It was also a rule that before starting the conductor must give two rings at the hand bell and have two back. She took the word of the deceased, who was a stranger to her, and who had introduced herself as a learner proceeding to another car. There were four or five passengers standing inside when the car started. Witness was away from the car a short time, and when she returned she saw the deceased on the platform. Witness thought the driver was still on the car.

Mr. G. A. Woolley, of the Darlaston depot, stated that since the accident a catch point had been put in, so that if a car started without the driver and conductor it would be thrown off the track and would stop in the soft earth beyond. The electric brake was only usable when the car was in motion. There were several objections why that brake should not be left on when the car was standing.

The Coroner informed the jury that after the last accident an application was made to Dudley Corporation for permission to make the ground level at the terminus, or to carry the cars round by Trindle House into Birmingham Road. This would have done away with any reliance on the frailties of human nature. He understood the Corporation could not see their way to allow it.

The jury returned the following verdict:—"Death from misadventure, caused by the carelessness of the conductress in releasing the brake without first convincing herself that she had received the proper signal to do so."

Neglect of a Rule at a Loop.

On February 9 the Dudley Coroner held an inquiry into the death of a motorman who was killed in a collision in a fog on the Dudley-Stourbridge route. The motorman of a car which was proceeding to Dudley said he was travelling towards the double line in Scotts Green at about four miles an hour. Suddenly he saw a flash from the trolley wire. He immediately applied the emergency brake, but the cars crashed into each other. Owing to the fact that he was going along without current, and that there was frost on the trolley wire, the lights on his car were nearly out. Witness said he was not due to meet any car until after he entered the double line. According to the rules for foggy weather he had the right of the road, and deceased should have waited. He saw nothing of the other car, and the only indication of its presence was the flash he saw on the wire.

An inspector stated that according to the rules deceased should have waited at the loop for the other car to pass, or have allowed his conductor to have piloted him along the single line to the junction.

The Coroner said it was a case of more rules having been forgotten.

Mr. O. C. Power (traffic manager to the company) said that, as the Coroner remarked the other day, it was the frailty of human nature.

The verdict was one of accidental death.

LONDON "SAFETY FIRST" COUNCIL.

Local Authorities Permitted to Pay a Subscription.

The second meeting of the London "Safety First" Council was held on February 16 at the Middlesex Guildhall, Westminster, Mr. W. Joynson-Hicks, M.P., presiding over an attendance of about 70 members.

It was reported that the Great Eastern Railway and the following additional local authorities had joined the Council:—Chelsea, Greenwich, Hammersmith, and Poplar. Messrs. J. D. Kiley, M.P., T. Gautrey, L.C.C. (London Teachers' Association), Murray Griffith, and Wallace B. Phillips were co-opted to the Council.

The Street Dangers Committee reported that they had elected Alderman Bisgood, of Richmond, as their chairman, and Mr. W. Willis, surveyor to the Chiswick U.D.C., as vice-chairman, and had appointed Street Lighting and Street Dangers sub-committees. The committee suggested that the police and the public should be recommended to reverse the present rule of the footpath, so that a pedestrian should be instructed to keep to the left instead of to the right. It was stated that nearly three times the number of fatal accidents occurred to pedestrians stepping off from the near-side pavement to the number leaving the offside pavement, and ultimately the recommendation of the committee was carried by a large majority.

The Publicity Committee had elected Councillor Newton Knights, Camberwell, as their chairman, and Councillor Butteriss, Willesden, as vice-chairman, and had, amongst other publicity arrangements, announced a prize competition to the value of £5 for the best couplet description of the objects of the "Safety First" campaign. This was creating a large amount of interest, over 1,000 entries having already been received.

The Drivers' Educational Committee had elected Alderman Dutfield as their chairman, and Mr. J. Devonshire as vice-chairman, and had appointed a sub-committee to draw up a programme of work.

The General Purposes Committee had appointed the chairman of the Council, Mr. W. Joynson-Hicks, M.P., as their chairman, and the vice-chairman, Sir Ed. Smith, L.C.C., and the Mayor of Hampstead, as vice-chairmen. Office accommodation had been provided at 31, Westminster Broadway, and the committee have offered five guineas as a first prize and two guineas as a second prize for a "Safety First" design, to be competed for by students of art schools, etc., in the Greater London area.

On the question of subscriptions to be paid by local authorities and others, the hon. secretaries reported that Lord Rhondda, president of the Local Government Board, had, after carefully considering the objects of the Council, agreed to sanction the payment by local authorities of a subscription of £5, and this amount was also fixed as a minimum for traction undertakings, associations and firms being left to contribute such sum as they might feel disposed.

The Council had an opportunity of hearing an interesting address by Mr. Wallace B. Phillips, a member of the "Safety First" Federation of America, explaining the American plan of campaign.

NATIONAL SERVICE AND SUBSTITUTION.

The Director-General of National Service has issued a list of trades and occupations of primary importance for which male volunteers between the ages of 18 and 61 are specially wanted. Included in the list are the following:—

Public Utility Services.—Police, fire brigades, salvage corps, electrical generating stations, tramways, omnibuses, and chars-a-bancs in connection with munition work.

Railway locomotive construction, railway carriage and wagon building, manufacture of traction engines, manufacture of internal combustion engines, motor wagon making, and repairing.

Electrical engineering, electrical accumulator manufacture and repairing, woodworking, lubricating oils and other lubricants, transport, munition, and rubber trades.

Mr. H. Faraday Proctor, hon. secretary, Incorporated Municipal Electrical Association, in accordance with the desires of the Reserved Occupations Committee, has forwarded to the members of the Association a copy of a memorandum issued by the committee for the guidance of electrical undertakings in effecting substitution by disabled soldiers, men of inferior medical categories, and women. The committee state that the wide reservation hitherto granted cannot be continued without modification after the end of February, and managers should as speedily as possible make every effort to release men for the army. In a covering letter Mr. Proctor says:—"The committee particularly desire that if a sufficiency of such disabled men is not forthcoming there may be no delay in introducing women for occupations where their services are capable of being used. You will probably be aware of what is being done in the matter of training disabled soldiers and sailors at the Northampton Institute and elsewhere, in which matter the Institution of Electrical Engineers is taking a prominent part. The question of data as to the sufficiency of men for the various positions, as also the question of technical advice in the matter of retaining a sufficiency of skilled operators in electricity works, is receiving attention at the present time."

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DUBLIN UNITED TRAMWAYS COMPANY.

Presiding at the 37th ordinary meeting on February 6, Mr. Wm. M. Murphy moved the adoption of the annual report and accounts, a summary of which appeared in our issue of February 8 together with a comparison with the figures for 1915, 1914, and 1913.

The Chairman observed that compared with many of their neighbours the company's property escaped wonderfully well from the damage entailed by the insane folly of some of their misguided countrymen last Easter. Their small direct loss of property was compensated for to some extent by the Government, but on presenting a claim for loss of £15,000 on traffic they were told that it did not come within the scope of either of the committees set up for considering claims. The directors intended to press their very equitable claim. They were in hopes of getting a substantial part of it. The continuous growth of traffic was shown by the remarkable way in which they recovered in the course of the year, for, notwithstanding the heavy losses due to the rebellion, they came out at the end of the year with £1,435 of an excess in gross receipts above those for 1915. On the whole, they might be thankful that the losses were not greater, as they might well have been, and that they were able to recommend out of the earnings of the year the payment of a dividend at the rate of 5 per cent. per annum for the second half of the year, making for the whole year 4½ per cent. on the ordinary shares, with substantial sums for appropriation to reserves. The gross receipts—£335,335—were the highest in the history of the company. The passenger receipts increased £1,850 over 1915, but as there was some falling off in parcels, the actual increase in gross receipts was £1,435. During the first three months of the year 1916 the receipts were £4,297 above the corresponding months in 1915, and there was almost a certainty that they would go on growing at the same rate of over £1,400 a month. Then came the fatal month of April, and in April and May, instead of gaining nearly £3,000, which they had every reason to anticipate, they lost £13,898. From the end of May they began to pick up again. If the receipts were a record the expenses were also a record, being £11,478 in excess of 1915. Of this excess, coal accounts for £5,219, though the quantity consumed owing to saving effected by various mechanical and electrical improvements was less by 1,230 tons. The price of coal, however, which averaged 18s. 5d. per ton in 1915, was 24s. 5½d. in 1916, an advance of 6s. 0½d. per ton, or nearly one-third, while in the pre-war days they had coal at one time as low as 9s. 8d. per ton. They would have to pay a still higher price when the contracts ran out in a month's time. "Maintenance" showed an increase of £3,694. Besides the abnormal cost of material, the cars had been greatly improved, and new and more powerful motors and electrical equipments had been fitted on several of the cars. Permanent way maintenance accounted for £1,646 of this increase, due to the enhanced cost of labour and materials. The only relaying of track executed was the work at Kingsbridge and Drumcondra Road, involved in the alteration of levels of the road by the Corporation. This work cost £2,234, which was charged against the special reserve. Though no other rails were relaid during the year, a good deal of the track was nearly due for renewal of rails, and they were setting aside £20,000 out of the surplus this year to the special reserve for that purpose, which, with the amount of £40,021 already to the credit of that account, would leave £60,000 in hand for relaying of track when it was possible to procure a supply of rails again. The item of "law and compensation" was down by £1,782; but rates and taxes were up by £3,519—or he should say that the income-tax was increased by £4,954, for the rates on the year actually decreased by £1,435. This was a pleasant, if novel, experience, but he was afraid that there were signs pointing in the direction of an addition to the rates. To show how the increased working costs had affected the profits, he might mention that though the receipts had been growing every year, except during the strike year of 1913, the percentage proportion of working expenses to receipts had gone up from 55 per cent. between 1909 and 1912 to 65 per cent. in 1916. In the face of all the burthens imposed on the company by the abnormal conditions, they were bound to consider the question of fares, which were in many particulars below the fares they were authorised to charge. The board had, however, refrained from increasing them, though they would have been justified in doing so, following the example of the Corporation, who controlled the electrical supply of the city, the price of which had been considerably raised more than once within the past few years. The company were entitled to claim credit for continuing to supply at the old price the service of which they had a monopoly, while the citizens had to pay more for municipal electricity and every other conceivable commodity. The company would probably not see for a long time the very low prices for coal and other materials that prevailed before the war. The revenue available—including £13,045 brought forward—left £91,194 for dividends and other appropriations. This would enable them to pay the preference dividend and a dividend for the second half of last year at the rate of 5 per cent. per annum on the ordinary shares. They proposed to appropriate £7,000 to the general reserve, which would bring that fund up to £65,679. After paying the dividends and appropriations, they would have £13,359 to carry forward, being £314 more than was brought in.

Mr. J. Mooney seconded the motion, which was adopted after Colonel Dopping had suggested that the chairman should interest himself in securing a railway connection between Castlecomer coal mines and the tramway to Kingsbridge. Old tramway rails might be used for the purpose, and thus save the cost of bringing coal from England.

The Chairman replied that the company could not undertake the work. It was outside their powers. The line ought to be made, but who ought to make it was a question about which he would not give any opinion there.

The following resolution was adopted:—"That the conversion into stock of the whole of the fully-paid preference shares in the capital of the company, to be called preference stock, and the conversion of the 66,000 ordinary shares issued and fully paid, to be called ordinary stock, be and the same are hereby sanctioned. The balance of the authorised capital, viz., 4,000 ordinary shares of £10 each, may also be converted into ordinary stock when issued and fully paid. That the said preference and ordinary shares when converted into stock be transferable in the books of the company, only in denominations of £10 or multiples of ten pounds."

FINANCIAL REPORTS AND MEETINGS.

South Staffordshire Tramways.—The accounts for 1916 show an available sum, including £753 brought in, of £4,122. The directors recommend a dividend of 4 per cent. on preference shares, carrying forward £844.

Llandudno and Colwyn Bay Electric Railway Company.—The profits for the year ended November 30 were £5,316, after providing for interest charges, and £431 was brought forward. A dividend of 4 per cent. was proposed, adding £1,615 to the sinking fund, and carrying forward £157.

Liverpool Overhead Railway.—The directors recommend a final dividend of 2 per cent. on the ordinary shares, making 3½ per cent. for the past year. The distribution was also 3½ per cent. for 1915, while 3 per cent. was paid for each of the two preceding years, and 2½ per cent. for 1912.

Liverpool Corporation Tramways.—The accounts for the year 1916 show a total income on revenue account of £749,279. After meeting traffic, general, power, and other expenses, the balance of £236,111 was carried to the net revenue account, the total income of which amounted to £253,400. Out of this sum a contribution of £125,000 was made in relief of the rates.

Sale of Siemens Brothers' Share Capital.—Under the Trading with the Enemy Amendment Act, the Public Trustee has invited tenders for the 119,000 shares of £5 each constituting the capital of Siemens Brothers and Company. Purchasers must be British-born subjects, and will be required to satisfy the Public Trustee as to their financial and technical ability to carry on the business efficiently. Tenders will be accepted up to noon on April 2.

Sunderland Corporation Tramways.—The Tramways Committee have agreed to appropriate the usual sum of £5,000 from the profits of the undertaking for the year ending March 31, 1917, to the relief of rates. The estimates show an estimated income of £85,352, as compared with £79,124 for 1915-16. The working expenses are put at £50,127, as against £44,467 for the preceding year. The estimated balance to be carried to net revenue account is £35,477, or £544 more than for the preceding year.

Lanarkshire Tramways Company.—For the year ended December 31, 1916, the revenue was £126,630, and the expenses £78,762. After deducting contributions payable to local authorities, interest on debentures, etc., and adding the balance of £958 brought forward, there is a balance of £23,602. The revenue shows an increase of £20,586, and the expenses an increase of £12,671. It has been impossible, owing to shortage of labour and difficulty in obtaining materials, to maintain the undertaking in the usual state of repair, and £2,500 has been transferred to maintenance reserve account for repairs when the war is over. The directors recommend that a dividend at the rate of 6½ per cent. per annum for the half-year ended December 31 last be paid. The contributions payable to local authorities, amounting to £2,865, are £1,135 in excess of the amount for the previous year.

City of Buenos Ayres Tramways.—The report of the City of Buenos Ayres Tramways Company (1904) for the year ended December 31 states that the annuity payable by the Anglo-Argentine Tramways Company has been received, and the net revenue amounted to £67,608. Interim dividends have been paid for the nine months ended September 30 last, absorbing £46,500, leaving £21,108. The directors recommend, in addition to the interim dividends already distributed, a final dividend of 1s. 3d. per share (making 5s. per share—5 per cent. per annum—less tax) for the year ended December 31 last, absorbing £15,500; that £5,500 be transferred to general amortisation fund, and that £108 be carried forward. The amortisation fund for the debenture stock, with accrued interest to date, amounts to £17,392, and the general amortisation fund for the redemption of the share capital now amounts to £56,846.

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Edinburgh Tramways Company.—Presiding at the annual meeting on February 5, Mr. Hall Blyth moved the adoption of the report, details of which were given in our issue of February 8. The traffic expenses were, he said, £64,000 in 1916, as against £60,673 the previous year, due to the increased rate of wages. Motive power expenses were £38,000, an increase of £14,000, being due to the break-up of the system, which involved a very large amount of extra power to drive the cables through the broken pulleys. The average price of coal was 13s. 2d., as against 8s. 6d., and 5,000 tons more were needed owing to the extra power required. Maintenance expenses had increased £25,000, due to the same cause, and while the total receipts were up £5,992, the net result was that there was a loss on the revenue account of £10,600 compared with a surplus of £28,000 from 1915. Mr. Cox, the engineer and manager, had during the year put the system in a better condition than it had been in for many years. To show how this was working out, he mentioned that during the first half of last year there was a decrease in passenger fares of £6,990, while at the end of the year the decrease had been turned into an increase of £8,226. They were negotiating with the Corporation as to taking over the undertaking at the end of the lease. Messrs. A. H. Laidley and W. Rutherford were re-elected directors.

DIVIDENDS OF THE LONDON UNDERGROUND GROUP.

Aggregate Results.—The traffic receipts of the five companies, parties to the common fund agreement, were £5,278,812 for the past year, and the gross receipts from all sources were £6,038,529. The amount retained for revenue liabilities was £5,531,561, and the remaining £506,968 was credited to the common fund.

Underground Electric Railways Company of London.—The revenue has enabled the company to pay the full interest to December 31 on its 6 per cent. first cumulative income debenture stock, and to pay 2 per cent., free of income-tax, on its 6 per cent. income bonds of 1948 for the half-year 1916, making 5 per cent., free of income-tax, for the year, with a carry forward of about £30,000.

Metropolitan District Railway.—The Metropolitan District Railway Company are entitled to 12 per cent. of the common fund, or £60,836, for the past year, and £13,952 was brought forward. A final dividend of 1½ per cent. is proposed on the second preference stock, making 3 per cent. for the twelve months, adding £10,000 to the reserve (making that fund £45,000), and carrying forward £20,688.

London General Omnibus Company.—The London General Omnibus Company are entitled to 32 per cent. of the common fund for the past year, against 40 per cent. twelve months ago, and will receive £162,229. The gross receipts were £3,092,736. A further dividend of 3 per cent. free of income-tax is proposed, making 8 per cent. for the past year, adding £198,330 to the reserve, and carrying forward £21,417. In 1915 the dividend was 12 per cent., and in 1914 sixteen per cent.

London Electric Railway.—The London Electric Railway Company are entitled to 30 per cent. of the common fund for the past year, against 26 per cent. a year ago, and will receive £152,090, while £12,303 was brought forward. The total net income was £590,190, and the sum available for dividend on the ordinary shares is £164,393. A final distribution of ¾ per cent. is proposed, making 1½ per cent. for the past year, and leaving to be carried forward £24,474, after adding £35,000 to the reserve.

City and South London Railway.—The City and South London Company are entitled to 6 per cent. of common fund, against only 2 per cent. in 1915, and receive £30,418 for 1916, while £9,027 was brought forward. The company's total net income was £124,488, and the sum available for dividend on ordinary stock is £39,445. A final dividend on the ordinary stock of ¾ per cent. is proposed, making 1½ per cent. for the year, and leaving to be carried forward £17,245, after adding £10,000 to the reserve fund.

Central London Railway.—The Central London Railway Company are entitled to 20 per cent. of the common fund, and will receive £101,393 for the past year, while £15,685 was brought forward. The total net income was £184,492, and the sum available for dividends on ordinary stocks is £117,079. A final distribution of 1¾ per cent. on the undivided ordinary stock is proposed, making 3½ per cent. for the twelve months, and the deferred ordinary stock will receive 3 per cent. for the full year, leaving to be carried forward £12,079, after adding £10,000 to the reserve.

Underground's Reduced Income from Investments.—The report of the Underground Electric Railway Company of London explains the falling off in the recent dividend statement of the allied companies. The net income from investments was £42,700 less at £664,666, and its interest and guarantees, plus income-tax, where paid, required £227,853, leaving a surplus of £436,812, as compared with £477,307 reported a year ago. The income-tax paid on the bonds, and the loss on foreign exchange in respect of coupons encashed abroad amounted to £134,015, an increase of £56,805, whilst the income received from the Associated Equipment Company (the manufacturing section of the L.G.O.C.) was only £143,000, as compared with £170,000.

CONTRACTS AND ORDERS.

The Bell Punch and Printing Company have an order to supply ticket punches to Leyton Urban Council.

Nelson Council have placed a contract with Messrs. Briggs, Jones and Gibson, Limited, of Manchester, for uniforms, coats, etc., for the women conductors.

Electric Vehicle Charging.—Sheffield Electricity Committee have placed a contract with Mortimore, Lyon and Company for plant required for charging electric vehicles.

Sunderland Council have placed the following contracts:—Babcock and Wilcox, Limited, boiler stanchion; British Mannesmann Tube Company, Limited, boiler tubes; Ferranti, Limited, extra high-tension switchgear; T. Ness, Limited, pitch and creosote oil.

Leeds Electricity Committee recommend the acceptance of the following tenders for plant, etc., at the new generating station:—Babcock and Wilcox, Limited, two water tube boilers and accessory plant, £12,959; Messrs. Wm. Airey and Son, foundations, seatings, and flues, £2,600.

Sheffield Council have accepted the following tenders:—Electric Construction Company, Limited, direct-current traction switchboard, converter, and feeder panels for Newhall Road sub-station; A. Reyrolle and Company, Limited, high-tension 3,000-volt sub-station switchboard; H. C. Hornbuckle, erection of sub-station, Newhall Road.

Edison Tower Wagon for Croydon.—With a view to facilitating overhead work on the tramways, Croydon Corporation have agreed to purchase an Edison battery chassis with charging gear, etc., at £921, for use as a tower wagon. The amount will be defrayed out of the reserve and renewals fund. The cost of running the wagon is estimated at £21 per annum, and purchase will enable the department to dispense with the use of a horse.

A Road Train, comprising a steam tractor and four trailers, is being purchased by the Metropolitan Asylums Board for use in the Dartford district. The tender of R. Garrett and Sons, Limited, Leiston, Suffolk, at £932, has been recommended for acceptance. Other tenders were Aveling and Porter, Limited, Rochester, £987; W. Tasker and Son, Limited, Andover, £993; Robey and Company, Limited, Lincoln, £1,092; J. Fowler and Company, Limited, Leeds (informal).

Switchgear for Greenwich Station.—The London County Council recently accepted the tender of the British Westinghouse Electric and Manufacturing Company, amounting to £2,694, and of Ferguson, Pailin and Company, Limited, amounting to £2,444, for alterations and additions to the switchgear in connection with the third new turbo-generator to be installed in Greenwich generating station. The tenders were submitted on the basis of payments under the contract being based on those specified in the model conditions of contract of the Institute of Electrical Engineers. The two firms are members of the British Electrical and Allied Manufacturers' Association, none of whose members will accept conditions of contract other than the general conditions of the Institute of Electrical Engineers, except as regards contracts for the War Department. The Highways Committee have advised that it is expedient that the Council should agree, as regards the present contracts, to the insertion therein of the payments clause of the Institute of Electrical Engineers, and this course was agreed to on February 6.

London County Council Contracts.—Arrangements have been made with the Tudor Accumulator Company, Limited, to maintain for a period of ten years, for £116 a year, a battery of 280 cells at the Greenwich Generating Station which was supplied by that company. On October 13, 1914, the Highways Committee accepted the tender of Siemens Brothers Dynamo Works, Limited, for the supply of 125,000 metallic filament traction lamps for £6,628 15s. 8d. The contract, the committee reported on February 6, has now been completed, and the total expenditure has amounted to £7,081. The Highways Committee also reported that they had sanctioned the purchase of tramway materials, etc., and the execution of small works and repairs, at an estimated cost of £24,895, and had accepted the following tenders for the supply of cotton covered copper wire:—London Electric Wire Company, and Smiths, Limited, £691; British Insulated and Helsby Cables, Limited, £1,353; Midland Electric Wire Company, Limited, £388. Tenders for the supply of 325 tons of rolled steel bar for magnetic brake shoes for the tramways department were received from the Lilleshall Company, Limited (for 200 tons) and from the Frodingham Iron and Steel Company, Limited. The tender of the latter firm was accepted. For 700 plough carriers the tender of T. Summersons and Son, Limited, Darlington, was accepted at £1 per bracket. The Highways Committee reported that it is necessary to make arrangements for the supply, during 1917-18, of tramway fittings, equipment, etc., and they suggest that as in previous years tenders should be invited from selected firms. The Western Electric Company, Limited, have supplied to the Council tramways about two miles of electric cable of various sizes for use in case of breakdowns, for £2,144.

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PERSONAL.

Mr. John Muir, the tire sales manager of Wood-Milne, Limited, Preston, has been appointed a director.

Mr. A. Tait, C.A., of Basildon House, Moorgate Street, E.C., has joined the boards of Callender's Cable and Construction Company, Limited, and of the Anchor Cable Company, Limited.

Alderman J. Tyrrell, J.P., and **Councillor J. C. White** were on February 7 elected chairman and vice-chairman of the Belfast Corporation Tramways Committee for the ensuing year.

Mr. W. H. Paull, of the Dunlop Rubber Company, has recently visited France at the invitation of the Government, investigating the performance of motor lorries and their tires in war service.

Mr. J. McLaren Calder's (chief assistant engineer of Reading Corporation Tramways) application for leave of absence for military service has been refused on the recommendation of the Tramways Committee.

Mr. S. L. Pearce has been given the title of chief engineer and manager of the electricity department of Manchester Corporation. The accountancy and secretarial departments have both been placed under his control.

Mr. Harry England, general manager and secretary of the Yorkshire (West Riding) Electric Tramways Company, and the staff were accorded a hearty vote of thanks at the recent annual meeting of the shareholders.

Alderman J. H. Palin, secretary to the Bradford branch of the Tramways and Vehicle Workers' Union, who has served as a member of the Tramways Committee, has received an appointment on the transport staff in France.

Mr. A. L. C. Fell's many friends will be glad to know that he has returned to his duties as chief officer of the London County Council Tramways, greatly improved in health as a result of his six months' leave of absence, during which he made a colonial tour.

Mr. C. C. Atchison has resigned the position of borough electrical engineer at Rochdale owing to his continued ill-health. He has held the appointment since 1900, and on the introduction of the tramways in 1902 he supervised that department for some time.

Sir Robert Hadfield, F.R.S., D.Sc., was, on February 13, elected a member of the Athenæum Club under the provisions of a rule that empowers the annual election of a certain number of persons "of distinguished eminence in science, literature, the arts, or for public services."

Leeds Appointments.—The Electricity Committee of Leeds have recommended the following appointments at the new generating station:—Mr. Ernest Porter, superintendent, at a salary of £280; Mr. H. Topham, engineer-in-charge, salary £140; Mr. C. H. King, works foreman, salary £182.

Mr. G. Stratton, resident manager and engineer, Sunderland District Electric Tramways Company, the staff, and the employees, were accorded a hearty vote of thanks at the annual meeting of the shareholders. Mr. R. H. Hogg, the chairman, observed that they had all given loyal and effective service during a trying time.

Mr. C. J. Hunt, who until recently was chief contract engineer to Bruce Peebles and Company, Limited, Edinburgh, has been appointed chief engineer to the company, and Mr. Wm. Oliver, who has for some time been acting chief estimating engineer (in the absence of Mr. R. Shaw, on active service), has been appointed chief contract engineer.

Mr. N. J. Young, manager of the Newport Corporation Tramways, and Mr. A. Nicholls Moore, borough electrical engineer and permanent way engineer, have been granted an increase in their salaries from £400 to £500. The salary of the deputy engineer was also increased. An amendment to defer the increases until after the war was defeated by 23 votes to seven.

Bradford Tramways Management.—Arrangements have been made whereby Mr. T. Stirk, traffic superintendent, and Mr. J. W. Dawson, assistant engineer, will carry on the management of Bradford Corporation Tramways while Mr. C. J. Spencer, the general manager, is engaged at the Admiralty on work in connection with the organisation of labour in shipyards and marine engineering works.

Bradford Salaries.—The following increases of salaries have been recommended:—Mr. T. Roles, city electrical engineer, from £800 to £900; Mr. J. Fairburn, superintendent, from £300 to £350; Mr. C. E. Allsopp, commercial assistant, from £250 to £300; Mr. J. W. Dawson, assistant engineer, tramways department, from £295 to £325; and Mr. T. Stirk, tramways traffic superintendent, from £270 to £300.

Professor Miles Walker, professor of electrical engineering at the Manchester Municipal School of Technology, on February 19 was voted an increase in his salary from £600 to £1,200 a year. The professor, who was appointed in 1912, is an inventor of a number of improvements in electrical machinery, and is consulting designer to the British Westinghouse Company. It was mentioned that he had been offered a post at £1,800 per annum, but he preferred to remain at the school. In supporting the increase, Mr. J. Maxwell Garnett, principal of the School of Technology, said Mr. Walker was the most distinguished professor of electrical engineering in this country. Within a few years municipal schools would have to offer £1,000 to £1,500 a year for the right type of men for their work.

Mr. J. M. McElroy's position with the Admiralty was not quite correctly described in a recent issue. He has been appointed director of a branch of the new department for the organisation of labour in shipbuilding and repair yards and marine engineering works. In addition to the assistance which, as previously mentioned, Mr. McElroy has given to the Ministry of Munitions and the Board of Trade regarding the questions of passenger transport in the neighbourhood of London, he has been managing member of the board of one of the National Shell Factories since its inception. He is also a director of the new National Instructional Workshops established in Manchester by the Ministry of Munitions, for the training of men for tool-room work in connection with the National Shell Factories and also for aero-engine work. Mr. McElroy's new duties prevent him continuing to occupy these positions, but he remains a member of the board of the National Shell Factory in question, although ceasing to be the managing member.

Mr. M. P. Flood, whose death is announced, was for sixteen years a member and vice-chairman of the board of the Dublin and Blessington Steam Tramways Company, and also a director of the Blessington and Poulaphonca Steam Tramway. The directors of both companies have forwarded a resolution of condolence to Mrs. Flood and family.

Alderman Joseph Brodie, chairman of Blackpool Corporation Electricity and Tramways Committee, died on February 19 after a long illness. The deceased gentleman had occupied the position of chairman for twenty years, and his able administration, combined with the excellent management of Mr. Charles Furness, the general manager and electrical engineer, had placed both undertakings in a strong position. Ald. Brodie was a welcome figure at the annual conferences of the Municipal Tramways Association and the Municipal Electrical Association.

WITH THE FORCES.

Sergeant P. Galley, York and Lancaster Regiment, formerly a Leeds tramcar conductor, has been awarded the D.C.M.

Mr. J. R. Mead, borough engineer of Ipswich, has accepted a commission in the Royal Engineers for service with the Roads Battalion in France.

Major H. Gray, borough electrical engineer, Accrington, has resigned his office. The Corporation have decided to pay him a salary of £140 a year until the end of the war.

Flight-Sergt. A. Forsyth, Royal Flying Corps, and formerly at the Rugby works of the British Thomson-Houston Company, has been awarded the Serbian Silver Star for distinguished service during the 1916 campaign.

Captain H. Richardson, R.E., city electrical engineer of Dundee and electrical engineer to the Corporation tramways, received mention in Sir Douglas Haig's recent dispatch. Captain Richardson has been in France for a year and a half.

Major Bertram Hopkinson, who has been awarded the C.M.G. for war services, has been professor of mechanism and applied mechanics at Cambridge University since 1903. While in practice as a consulting engineer with his father, the late Professor John Hopkinson, and Mr. E. Talbot, he and his partners designed several electric tramways, including Leeds and Newcastle-on-Tyne.

Mr. L. C. F. Bellamy, who is serving as an officer in the Royal Engineers on the Western front, has received notice from Ilkeston Corporation of the termination of his appointment as manager and engineer of the tramways and electricity undertakings, in consequence of the sale of the undertaking to the Notts and Derbyshire Tramways Company. In acknowledging the communication, Lieutenant Bellamy said he considered the Council had made an excellent bargain with the company. He much appreciated the generous way in which he and the other ex-tramwaymen were being treated by the Council.

Lieutenant E. G. Waters, Royal Flying Corps, was killed in France on January 24 during an encounter with the enemy while acting as escort to an officer who was engaged in photographic work. The gallant officer, who was shortly to have been promoted to flight commander, was formerly with Callender's Cable and Construction Company and Ferranti, Limited.

Sergeant J. Smith, Scottish Rifles, who has been killed in action, was employed before the war in the permanent way department of Blackburn Corporation Tramways. He was wounded at Loos last year, and had been awarded the Military Medal for taking command of his company when all the officers had fallen, and fighting a successful battle for many hours, eventually bringing the remnant of the company out of action.

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TRAMWAY AND LIGHT RAILWAY NOTES.

BRADFORD.

A Loading Problem—Women Conductors and Brake Manipulation—The Substitution Scheme.

The tramways department have been asked by Birkenshaw Council to make arrangements, if possible, to enable Birkenshaw passengers to travel to their destination by the Birkenshaw cars from Dudley Hill barrier. It is complained that they are crowded out by Dudley Hill people being allowed to board Birkenshaw cars at the Town Hall before these cars reach the Dudley Hill barrier. A member of the complaining Council suggests that only threepenny tickets be issued at the Birkenshaw barrier, the cars to fill up at the Dudley Hill barrier with penny and twopenny stage passengers. At the inquest on the body of a woman conductor who died from injuries sustained through a car running away at Wyke during the driver's absence, the jury found that the accident was due to the brakes not being properly applied. Consent was given to call evidence of the training. John Hemingway, master of the tramway training school, stated that the women conductors were given demonstrations of how to apply brakes. Cross-examined, he admitted some handling of them might inspire confidence. Mr. C. J. Spencer, general manager, said that however finished was the training they were up against the human element. They could not guarantee how a person would act in emergencies. Up to February 8 about a dozen motormen from the army, not classified for service under Class A, had been returned to their employment with the Bradford Corporation Tramways in exchange for men up to 30 years of age who are in Class A.

BIRMINGHAM.

More Volunteer Motormen Wanted—The Recent Power Shortage.

An appeal has been made by Birmingham tramways management for additional volunteers to be trained as motormen. The department is about to lose the services of 150 men whose exemptions from military service have been withdrawn. Owing to the narrow gauge and the gradients it is not considered advisable to train women for the work. The report has been completed of the special committee appointed by the City Council to inquire into the affairs of the Electric Supply Committee with particular reference to the recent prolonged failure to provide sufficient energy for the operation of the tramcars. On February 28 the Electric Supply Committee held a meeting, at which they drafted a reply to the report for presentation to the next meeting of the Corporation. The main reason for the failure of the supply, the special committee point out, was the over-pressure resulting from the heavy demands for electricity by munition factories and other works.

HUDDERSFIELD.

Fewer Stopping Places.

From motives of economy, as well as to ensure the safety of the public by not stopping at unimportant points where there is little light, the Huddersfield Corporation Tramways Committee have decided to suspend several stopping places on various routes.

HULL.

Platform Collection—Stoppages to Collect Fares.

Mr. W. J. McCombe, manager of Hull Corporation Tramways, in a report to his committee on the subject of fares, stages and stopping-places, stated that it had been suggested it was not necessary for all the cars to run to the extreme end of the routes, but that short journey cars should be run. This was done now in the case of cars to Dairycoates and to the depot entrance on the Hedon Road. The question of the convenience of the public was first to be considered, but he suggested that the arrangement be also tried on the Holderness road route, where there is heavy congestion of traffic at certain times of the day. The manager added that at present the women conductors saved themselves trouble by taking fares on the platform before the passengers ascended, but it might be made more general, and he proposed to extend this instruction to all conductors at all times. With reference to the more careful collection of fares to avoid leakage, the manager stated that the drivers and conductors had instructions, when the car was full, to come to a standstill a number of stopping places away from a stage point, so that the conductor may have an opportunity of collecting all fares without exception. This was absolutely necessary at times of heavy pressure. It might be well to establish a compulsory stop at a point some distance from all stage-points to take effect throughout the day after 9 a.m., this regulation to be observed, without exception, every journey after the halfpenny fare period. This would, he thought, help towards preventing a leakage in fares.

ILKESTON.

Proposed Purchase of the Tramways.

The Parliamentary Committee of the Notts County Council have reported that with regard to the proposal to transfer the Ilkeston tramway undertaking to the Notts and Derbyshire Tramways Company no objection could be made, but the clause, "To enable the company to purchase undertakings which could be worked in connection with it," was of very wide effect, and would probably be objected to on principle when the Bill reached the House. The promoters had been asked to withdraw the clause, and if they declined the committee would, if necessary, present a petition against the Bill. The Examiners of Bills have found that the Notts and Derby Tramways Bill had duly complied with the Standing Orders, and have sent it for first reading.

LEEDS.

Extension of Freight Service.

A contract has been awarded to Messrs. C. Bushby and Sons at £1,550 10s. for the construction of a light railway between the Leeds Fireclay Company's junction and the existing light railway. The Leeds tramways have for a considerable period carried freight for the Fireclay Company. Particulars of this and other freight services at Leeds were given in the illustrated paper on "The Utilisation of Tramways for Goods Traffic," which was presented by Messrs. G. W. Holford and W. Clough to the last annual conference of the Municipal Tramways Association. The paper was printed in full in the issue of the Tramway and Railway World for October 12 last.

LIVERPOOL.

Reducing Mileage and Increasing the Service—Revision of Stages Deferred—Forthcoming Unique Enterprise.

The Tramways Committee have authorised Mr. C. W. Mallins, general manager, to put in operation, as soon as the arrangements can be made, a scheme which he has devised to economise in mileage run at the extreme ends of the various routes, and so afford a more frequent service of cars during the crush hours. The scheme sets up four belt routes, to be used at least during the morning and evening busy period. In each case the belt route starts at the Old Haymarket. The Tramways Committee, after receiving reports from the general manager and the city engineer on the suggested revision of tramway stages, have decided to defer consideration of the same until after the war. In the course of the budget debate of the Corporation, Councillor Russell Taylor, chairman of the Tramways Committee, announced that before a long period elapsed the Tramways Committee hoped to introduce a scheme for affording increased tramway facilities such as were not offered to the public in any other town. He also mentioned, in connection with the grant of £65,000 in relief of the rates, that if one-fifth of a penny were taken off the average penny fare the entire profit would practically be wiped out.

LONDON.

Inquiry into Services—Emergency Supply of Power—Burden of War Wages.

The London County Council have been informed by their Highways Committee that they have appointed a special sub-committee to consider and report whether any alterations should be made in connection with the tramways services and fares and methods of collection of fares. The members of the sub-committee are Messrs. W. Haydon, T. F. Hobson, and H. Ward, together with Mr. G. H. Hume, chairman, and Mr. T. Prestige, vice-chairman. Alterations to switchgear at a cost of £362 had to be made in connection with the temporary supply of power obtained from the London Electric Supply Corporation for working the tramways. After March 31 a stand-by supply, up to 3,000 kw., will be furnished in case of emergency by one party to the other until the termination of the war and thereafter subject to three months' notice by either side, the party receiving the supply to provide the other party with a similar quantity at the earliest convenient time, no payment being made. The Highways Committee and the Metropolitan Electric Tramways, Limited, have agreed that during the war the through running receipts on the routes from Holborn via Manor House shall be pooled and divided on an equal earnings basis, as is already done on the Euston Road to Enfield route. The original arrangement was for the allocation of the receipts according to the amount earned per car-mile on the portion of the route in the area of each authority. Checks to ascertain the actual earnings a car-mile have been taken every three months, but under existing conditions it has been found impossible to obtain even an approximate result. The full annual cost of meeting the war wages and bonus awards given in February by Courts of Arbitration to the tramway employees of the London County Council is estimated at £69,970. Of that sum £46,325 is allotted to the traffic section. The total extra cost of the burdens placed upon the tramways undertaking from the outbreak of the war to March 31, 1917, is as appended:—War bonus and war wages, £172,150; increase in rates of pay, £8,300; war service allowance, £250,950; total, £431,400. On the basis of the present establishment, the additional annual cost under these three heads is £268,400, equivalent to a charge of 1·288d. per car-mile run. The cost of the salaries and wages in the department increased from 4·70d. per car-mile in 1911 to 5·60d. per car-mile in 1915-16. A special sub-committee has been appointed by the Highways Committee to "consider what steps shall be taken to meet the heavy charges which will fall upon the tramways account."

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MANCHESTER.

TRAFFIC CONGESTION PROBLEM.

Following the reception of reports from the Tramways Committee, the Watch Committee and the Improvements and Buildings Committee, the Corporation of Manchester appointed a Traffic Congestion Committee to consider the best means of relieving the pressure of traffic in the central parts of the city. A sub-committee of the Traffic Congestion Committee have prepared a draft report suggesting consideration of the following proposals :—Use of a portion of the old Infirmary site for the establishment of a tramway terminus and for the erection of tramway and other municipal offices, the use of other open spaces and squares in the centre of the city for tramway terminals, the construction of six new arteries, and a reduction of tramway traffic within a prescribed area in the centre of the city.

NEWCASTLE-ON-TYNE.

LIABILITY FOR PASSENGERS' LUGGAGE.

His Honour Judge Greenwell, on February 15, gave judgment at Newcastle County Court in the claim in which Miss Hewitson, sued the Corporation for £9, the value of a suit case and its contents, which she had placed on the rear platform of a tramcar, paying a penny for a ticket for the luggage. The statute required free carriage of passengers' luggage up to 28 lbs., and if it was less, as in this case, the Corporation, his Honour stated, became common carriers when they accepted a penny for its conveyance. They attempted to limit the liability by a ticket that had a clause on it in type so small that it was impossible to be read except by good eyes in a strong light. He had seen no notice in the cars disclaiming responsibility. In the Corporation Acts and by-laws he could find no authority given for the penny charge. After quoting governing cases, his Honour remarked that in one judgment it was said the ticket was no more than a receipt. He decided that the Corporation were common carriers, and had failed to contract out of their liability, and he gave judgment for plaintiff for the amount claimed. To a suggestion that the Corporation might relieve themselves of the liability by placing notices in the cars, his Honour replied that that course would not be sufficient if the ticket were given before passengers saw the notice or had their attention drawn to it.

PLYMOUTH.

NEW FARE BY-LAW.

Plymouth Corporation are likely to be the next tramways authority to apply for sanction to a new by-law rendering it obligatory for each passenger to pay the fare on leaving the car or on demand before leaving. The new regulation has been provisionally adopted by the Tramways Committee.

SHEFFIELD.

PURCHASE OF LONDON CARS—CONVERSION OF SINGLE-DECK CARS—INDUSTRIAL DEVELOPMENT.

The chairman of the Highways Committee of the London County Council informed the Council on February 20 that the price of the ten cars that had been sold to the Sheffield Corporation was fixed at £450 per car. The cars were of a type that the Council are not now using, and they were not required. Sheffield needed some cars, and had been unable to secure the permit from the Ministry of Munitions for the purchase of new cars. Sheffield tramways department are converting a number of single-deck cars to double-deck and placing top covers thereon. It is proposed to defray the cost out of revenue. Until Parliamentary powers have been obtained to carry on a development department by publicity and other methods at the expense of the rates, the Industrial Development Committee of the Corporation recommend that the cost should be defrayed out of the profits of the tramways department. To meet the demand anticipated for electric energy, a new generating station is to be erected.

WALTHAMSTOW.

TRANSFER TICKETS AND FRAUD.

Mr. W. Murray, general manager, Walthamstow Council Tramways, has reported that in a certain portion of the district persons had exchanged transfer tickets and used them in such a way as to defraud the Council of a halfpenny fare. The Council have consequently decided that in future transfer tickets be issued only after 8 a.m.

London Street Accidents.—In the House of Commons on February 26 the Home Secretary stated that the number of fatal accidents in the Metropolitan district during the hours of darkness between August 1, 1914, and January 31, 1917, was 954. The number killed by Zeppelins in the same district was 137. The figures for the City were 29 fatal accidents and 13 persons killed by Zeppelins. Sir G. Cave said the policy of lighting had just been reconsidered and alterations made.

The London County Council announces that in connection with the through running tramway arrangements with the authorities of West Ham, East Ham, and Leyton, those three authorities have discontinued halfpenny fares.

WOMEN AS DRIVERS OF PUBLIC VEHICLES.

LICENCES TO BE GRANTED IN LONDON.

Replying in the House of Commons on February 12 to a question by Sir Henry Norman, the Home Secretary (Sir George Cave) said :—"In view of the opinion of the Army Council that it has become necessary to call up certain drivers hitherto exempted by the Tribunals, the Commissioner of Police, who is the licensing authority, proposes, with my approval, to licence qualified women to be drivers of public carriages."

That the Home Office are now fully awake to the seriousness of the situation is shown by the fact that on February 16 the Metropolitan Police took counsel with a number of managers of London, Scottish, and provincial traction undertakings, women drivers having been introduced on over a dozen tramways in the provinces and in Scotland during the past eighteen months. Among the visitors was the general manager of the Glasgow Corporation Tramways. Mr. J. Dalrymple was able to speak of the successful training of some 250 women as tramcar drivers in Glasgow, where they have been gradually introduced since October, 1915, without serious accidents. In his New Year address to the employees Mr. Dalrymple urged every woman conductor to undergo training in driving with a view to meeting any contingency. A further indication of the Glasgow manager's view was given in a short speech that he made on February 22 in acknowledging the toast of the tramways staff, submitted at a luncheon given by the Tramways Committee in celebration of the extinction of the debt on the tramways undertaking. Mr. Dalrymple remarked that they had almost come to a point when the majority of the staff was of the gentler sex, that he had learned very much during the past two years, and that he would not hesitate to have the whole service run by women.

In the metropolis the shortage of motormen has become increasingly pronounced during the past few months, and in January last the Walthamstow Council asked the Home Office to sanction the employment of women as drivers. The matter has also been engaging the attention of the Highways Committee of the County Council for a long time, according to a statement made by Mr. G. H. Hume, the chairman of the committee. In an interview Mr. Hume added :—"The consent of the police has removed one obstacle to the employment of women drivers, but I believe the trade union strongly object to them. It is quite possible that we shall test women for driving. We are keen to get more drivers in order to send out more cars, and if we can secure women of sufficient capability there is no reason why they should not become drivers."

The Home Office decision applies to all kinds of public vehicle.

PATENT LIST.

Abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

*** If the inventions have been communicated the names of the communicators are given below in italics.

APPLICATIONS FOR LETTERS PATENT.

Lighting outfit for road vehicles (1,687)—G. Bothwell.

Arrangement and disposition of springing and power transmission members of motor vehicles (1,769)—G. E. Bradshaw.

Means for signalling direction of travel of trackless vehicles (1,413)—H. T. Dobbs and E. T. John.

Motor vehicles (1,760)—G. and V. R., Limited, and A. G. Grice.

Radius-rod and torque-rod assembly for motor vehicles (1,743)—Halley's Industrial Motor Vehicles, Limited, and G. H. Halley.

Advertising on and adjacent to railways and tramways (1,487)—D. Matthews.

Car truck (1,750)—G. K. Thompson.

Differential gear of motor vehicles (1,414)—A. H. Williams.

Fare-ticket devices for omnibuses, etc. (1,807)—W. Aitken.

Non-slipping devices for resilient tires (1,869)—I. Brook.

Motor vehicles (1,872)—W. E. Clarke, C. H. Crawley and M. E. Starkey.

Trolley wire locator (1,971)—F. J. Davis and W. F. Hunt.

Automatic trolley alarm for electric tramcars (1,921)—Horstmann Gear Company and R. Dodd.

Tires for motor vehicles (1,782)—Gofa Tire Company and W. C. Platts.

Self-propelled vehicles (2,061)—R. F. Macfie.

Trolley heads for electric traction (2,026)—W. Pickersgill and J. H. Pitt.

Starting gear for motor vehicles (2,042)—Triumph Cycle Company and G. E. Stanley.

Railway signalling and train control systems (1,898)—B. Starie.

Continuous cab-signalling system for railways (1,899)—B. Starie.

Train stop and speed control systems for railways (1,900)—B. Starie.

Signal devices for road vehicles (2,261)—W. Ashworth.

Variable-speed liquid drive and clutch combined for motor vehicles (2,312)—A. E. Carter and J. Healy.

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Motor road vehicles (2,102)—A. B. Chapelle.
Covers for exposed seats of omnibuses (2,352)—F. O. Clapcott.
Spring tires for wheels of motor road vehicles (2,105)—A. E. Coxhead.
Mechanically operated signal device (2,287)—A. E. T. Dudgeon.
Railway joints (2,364)—J. Elliott.
Self-propelled vehicles (2,072)—T. E. T. Griffith s.
Electro-magnetic brake (2,103)—H. V James.
Track chains for heavy mechanically-propelled vehicles (2,278)—Metropolitan Carriage, Wagon, and Finance Company and W. G. Wilson.
Permanent way of railways (2,363)—J. P. O'Donnell (*J. Williams*).
Method of attaching parts of small gauge railway vehicles (2,124)—F. C. J. E. Peeters.
Variable speed gearing for automobiles (2,170)—H. G. O. Robinson.
Reinforced concrete railway sleepers (2,313)—C. W. Simpson.
Motor road vehicles (2,102)—J. A. Towers.

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Combined clutch and differential drive for motor cars (2,245)—G. W. Wadden.
Combined electric generating and self-starting mechanism for motor vehicles (2,650)—E. Aron and E. Hill.
Blocks for holding rails in railway chairs (2,583)—E. Atkinson.
Means for holding tram and railway tickets (2,670)—T. Bettney.
Electrical driving gear for motor cars (2,591)—H. Crochat.
Adjustable self-starter for automobiles (2,407)—J. Kluijtmans.
Means for actuating points of tramways (2,558)—W. Martin and M. Russell.
Safety guards for motor vehicles (2,682)—F. A. Poupard.

Specifications Published.

1916.

In the following list the numbers in italics are those that the specifications will finally bear and under which they will be indexed and abridged before acceptance and finally printed. The application numbers should, however, still be used for correspondence purposes.

Electric controller, particularly for use with electrically propelled vehicles (70—*102,981*)—J. E. Hamilton.
Car trucks (144—*100,726*)—W. S. Adams.
Power transmission on rail and road trains, etc. (241—*102,987*)—J. G. P. Thomas and Thomas Transmission, Limited.
Spring suspensions (3,289—*103,033*)—J. Robinson.
Metal railway sleepers and chairs (16,426—*103,102*)—G. J. Fisher.
Apparatus for operating points and signals (229—*103,134*)—Railway Signal Company and W. S. Roberts.
Motor vehicle wheels (843—*103,171*)—C. V. Boys.
Motor wheel (885—*103,174*)—S. W. Neldner.
Electric locomotives (5,934—*103,235*)—British Thomson-Houston Company (*General Electric Company*).
Points for tramways and railways (5,972—*103,236*)—R. B. Holt.
Rail anti-creepers (10,618—*103,262*)—B. B. Betts.
Electric locomotives (4,334—*103,387*)—British Thomson-Houston Company (*General Electric Company*).
Safety and quick operating shackle for trains, trams, and trollies (4,738—*103,391*)—D. D. Jones.
Road vehicles and trailers (8,891—*103,427*)—R. B. Fageol.
Railway vehicles (935—*103,495*)—T. F. Craddock (*Burn and Company* and *A. Craven*).
Spring suspension devices of motor vehicles (1,276—*103,515*)—W. B. Goodwin.
Railway point and signal apparatus (1,747—*103,539*)—C. L. Hollands.
Means for controlling the electric lighting of motor vehicles (4,343—*103,558*)—W. Curtis.
Metallic spring keys for railway chairs (7,142—*103,594*)—C. Ross, Limited, and W. H. Flood.
Safety controlling gear for electrically propelled vehicles (12,406—*103,617*)—F. Garrett and H. K. Pratt.
Mechanism for facilitating the instruction of drivers of self-propelled vehicles (12,500—*101,414*)—J. G. Torr.

Colonial and Foreign Tramways Traffic Returns.

NAME OF COMPANY.	1916. WEEKS ENDED.					1917. WEEKS ENDED.					AGGREGATE.		
	Feb. 5.	Feb. 12.	Feb. 19.	Feb. 26.	—	Feb. 3.	Feb. 10.	Feb. 17.	Feb. 24.	—	Wks.	1917.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Anglo-Argentine	49,591	50,263	50,359	48,957	...	47,614	50,673	53,000	47,936	...	8	398,172	+ 2,931
Auckland	(28 days)	20,518	...	...	...	(28 days)	21,199	...	...	...	32	171,873	+ 2,647
Calcutta ... ... Rs.	66,280	65,948	66,793	68,577	...	69,797	68,397	68,258	71,556	...	8	560,447	+ 27,318
Madras ... ... Rs.	...	...	29,860	(14 days)	...	35,311	(14 days)	33,622	(14 days)	...	6	105,426	+ 9,183
Pernambuco	3,082	2,987	2,971	2,962	...	3,655	3,441	3,840	3,735	...	8	28,885	+ 4,309

Companies Issuing Monthly Statements.

	1915.				1916.		1916.				1917.		Wks.	AGGREGATE.	
	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.		1916-17.	+ or −.
	£	£	£	£	£	£	£	£	£	£	£	£		£	£
Ballarat & Bendigo ...	3,401	3,586	3,396	4,437	...	...	3,390	3,429	3,089	3,980	...	...	40	32,608	− 321
Brazilian Traction Mrs	6494000	6793000	6336000	7082000	...	...	6920000	7037000	6943000	6527000	...	...	52	82,311,000	+5,197,890
Brisbane	30,360	31,880	31,120	...	32,280	...	32,530	32,760	26,740	...	33,020	...	4	33,020	+ 740
British Columbia $	517,022	538,826	562,782	603,667	591,949	...	540,440	573,544	604,576	631,644	627,130	...	30	4,065,920	+ 233,825
Buenos Ayres Lacroze	39,355	43,516	46,033	43,528	40,595	39,137	37,075	39,670	42,603	40,106	38,142	35,977	34	305,014	− 25,649
Burma	22,163	25,531	23,695	22,185	21,906	...	23,749	29,768	26,824	30,250	23,803	...	26	158,806	+ 18,167
Cape Town	...	...	...	...	16,030	...	...	14,238	...	...	18,440	...	4	18,440	+ 2,410
Carthagena & Herrerias	1,252	2,169	2,090	2,129	2,841	1,585	1,779	2,539	2,252	2,399	3,982	3,223	8	7,205	+ 2,779
Cordoba	13,210	13,441	13,798	13,026	12,335	...	13,389	13,533	12,836	12,327	12,437	...	44	135,687	− 820
East India	2,054	2,069	2,065	2,062	2,015	1,863	2,523	2,080	1,942	2,120	1,836	1,570	30	14,593	+ 199
Kalgoorlie	2,997	2,675	2,611	...	...	...	2,788	2,716	2,555	...	...	...	48	28,538	− 1,864
La Plata	3,894	4,405	4,564	4,563	4,533	4,345	3,994	4,435	4,342	4,436	4,315	4,092	8	8,407	− 471
Lima	30,530	32,211	30,720	35,110	...	...	33,348	33,292	33,625	35,845	...	...	52	406,820	+ 20,498
Manaos ... Rs.	...	...	...	...	...	...	141,286	...	142,858	...	...	...	—	—	—
Manila	...	...	...	...	...	...	...	...	...	...	...	...	31	887,739	+ 39,986
Mexico ... $	...	...	...	...	...	...	...	...	...	...	...	...	—	—	—
Monte Video	25,070	27,167	28,407	31,305	34,252	32,502	26,711	...	28,404	31,364	33,341	32,304	17	125,413	− 1,053
Peruvian ... $	755,280	806,900	751,720	823,600	862,100	775,700	911,910	945,590	925,820	990,842	935,130	844,770	34	7,285,392	+ 966,215
Port Elisabeth ...	...	...	...	...	4,193	...	...	3,131	...	...	4,498	...	4	4,498	+ 305
Rangoon	4,445	4,886	5,028	4,492	...	...	4,137	5,043	5,033	4,904	...	...	52	56,308	− 1,427
Toronto ... $	804,902	792,001	851,113	...	906,350	...	913 535	907.460	911,829	...	1002469	...	4	1,002,469	+ 96,119
Winnipeg ... $	261,982	286,146	323,025	...	297,560	...	267,497	278,817	282,899	...	319,945	...	4	319,945	− 22,385

(Continued on page 184)

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TRAFFIC RETURNS—*continued.*

Tramways and Omnibus Undertakings in the United Kingdom.

NAME OF COMPANY OR CORPORATION.	1916. WEEKS ENDED.					1917. WEEKS ENDED.					AGGREGATE.		
	Feb. 5.	Feb. 12.	Feb. 19.	Feb. 26.	—	Feb. 3.	Feb. 10.	Feb. 17.	Feb. 24.	—	Wks.	1917.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Aberdare U.D. Council	379	373	368	364	...	373	350	363	395	...	47	18,482	+ 1,701
Aberdeen Corporation	1,683	1,689	1,634	1,646	...	1,728	1,717	1,739	1,736	...	38	72,350	+ 3,959
Accrington Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
Ayr Corporation	265	251	259	249	...	253	252	258	268	...	41	16,408	+ 1,260
Bath Electric	*	...	...	...	...	...	...	...	...	...	—	—	—
Birkenhead Corporation	1,389	1,360	1,372	1,326	...	1,441	1,383	1,462	1,502	...	47½	72,421	+ 6,652
Birmingham Corporation	15,351	15,310	15,529	14,452	...	15,828	15,451	16,064	16,250	...	47	748,196	+ 58,131
Birmingham Corp. Motor Omnibuses	799	770	779	626	...	850	807	848	817	...	47	45,717	+ 6,067
Blackburn Corporation	1,091	1,074	1,050	1,045	...	969	959	1,069	1,101	...	47⅝	57,901	− 1,363
Blackpool and Fleetwood	370	283	288	273	...	334	243	231	272	...	7	2,307	− 264
Blackpool Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
Bolton Corporation	2,575	2,648	2,550	2,466	...	2,622	2,703	2,809	2,789	...	48	137,366	+ 9,148
Bournemouth Corporation	1,886	1,906	1,818	1,690	...	1,716	1,703	1,715	1,826	...	48	106,438	+ 5,719
Bradford Corporation	6,215	6,046	5,936	5,653	...	6,053	5,922	6,122	6,175	...	47	316,541	+ 10,417
Brighton Corporation	882	...	...	...	...	848	...	...	...	...	44⅔	55,065	+ 5,660
Bristol	4,586	4,472	4,479	4,252	...	4,301	4,153	4,355	4,587	...	7⅓	34,391	− 2,022
Burnley Corporation	1,659	1,590	1,512	1,445	...	...	1,500	1,474	1,572	...	—	—	—
Burton-on-Trent Corporation	273	226	220	216	...	256	247	253	262	...	47	13,182	− 576
Bury Corporation	1,231	1,235	1,209	1,153	...	1,228	1,214	1,324	1,321	...	47⅞	66,594	+ 2,700
Cardiff Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
Chatham and District	1,033	1,033	1,079	984	...	1,005	996	1,093	1,118	...	8	8,022	− 277
Chesterfield Corporation	249	248	251	253	...	231	238	237	240	...	47	12,728	+ 12
Colne Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
Cork Electric	473	452	447	421	...	427	419	412	490	...	8	3,342	− 242
Croydon Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
Derby Corporation	1,062	955	1,032	858	...	981	972	1,021	1,007	...	47½	52,499	+ 2,631
Dover Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
Dublin and Lucan	128	111	109	109	...	122	97	110	120	...	8	882	− 33
Dublin United	5,912	5,599	5,749	5,547	...	5,660	5,578	5,739	6,089	...	8	45,654	+ 284
Dundee City	1,339	1,294	1,294	1,279	...	1,267	1,300	1,317	1,302	...	40⅞	55,910	+ 938
East Ham Corporation	1,213	1,159	1,203	1,171	...	1,110	1,033	1,129	1,146	...	47½	59,325	− 1,574
Exeter Corporation	328	316	324	294	...	303	322	328	325	...	47	18,593	+ 1,003
Gearless Motor 'Buses	*	...	...	...	...	...	...	...	...	...	—	—	—
Glasgow Corporation	22,633	21,581	21,769	21,446	...	23,081	23,272	23,086	23,396	...	38⅛	903,647	+ 64,117
Glossop (Urban Elec. Supply Co.)	134	125	127	106	...	120	109	120	124	...	8	996	− 28
Halifax Corporation	2,029	1,869	1,851	1,841	...	1,788	1,818	1,791	1,862	...	46⅞	101,230	+ 244
Halifax Corp. Motor Omnibuses	47	44	39	40	...	45	46	44	41	...	46⅞	2,296	+ 36
Hastings and District	728	724	714	644	...	765	767	822	837	...	8	6,903	+ 1,039
Huddersfield Corporation	2,645	2,562	2,620	2,405	...	2,554	2,499	2,505	2,612	...	47	131,571	+ 8,726
Hull Corporation	3,094	2,993	3,089	3,118	...	3,336	3,199	3,013	2,988	...	47	148,752	+ 1,709
Ilford U.D. Council	605	597	612	568	...	555	569	589	611	...	47	31,329	+ 1,001
Ilkeston Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
Ipswich Corporation	452	477	499	453	...	357	365	367	375	...	47	23,266	− 2,243
Isle of Thanet	224	238	230	198	...	193	205	226	222	...	21	5,200	− 161
Kilmarnock Corporation	165	157	161	150	...	158	154	160	168	...	40⅞	7,117	+ 222
Lanarkshire	2,171	2,108	2,044	2,198	...	2,260	2,297	2,339	2,279	...	8	18,116	+ 955
Lancashire United	1,616	1,545	1,581	1,584	...	1,642	1,540	1,604	1,744	...	8	12,705	+ 494
Leeds City	8,957	8,553	8,790	8,438	...	9,187	9,006	9,145	9,188	...	48	460,181	+ 36,824
Leicester Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
Leith Corporation	763	748	710	726	...	819	826	834	840	...	40⅞	35,668	+ 4,327
Leyton U.D. Council	1,454	1,440	1,456	1,402	...	1,441	1,388	1,508	1,531	...	47	76,129	+ 471
Liverpool Corporation	13,339	12,837	13,004	12,479	...	13,654	13,180	13,598	13,972	...	7⅛	109,780	+ 4,297
Llandudno and Colwyn Bay	190	190	195	184	...	155	152	181	174	...	12½	2,224	− 109
London County Council	44,290	44,255	44,691	44,285	...	43,276	39,076	42,620	43,991	...	46½	2,209,686	+137,157
London General Omnibus	*	...	...	...	...	...	...	...	...	...	—	—	—
London United	*	...	...	...	...	...	...	...	...	...	—	—	—
Lowestoft Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
Maidstone Corporation	180	171	172	164	...	157	158	165	173	...	47	9,980	− 139
Manchester Corporation	17,150	16,916	17,178	16,804	...	17,642	16,430	17,664	18,213	...	45	878,892	+ 38,264
Metropolitan Electric Tramways	*	...	...	...	...	...	...	...	...	...	—	—	—
National Steam Car	*	...	...	...	...	...	...	...	...	...	—	—	—
Nelson Corporation	183	179	193	...	...	193	180	189	...	...	46½	9,707	+ 627
Newcastle-on-Tyne Corporation	5,632	5,633	5,662	...	...	6,744	6,619	6,667	...	...	46	310,571	+ 24,449
Newport (Mon.) Corporation	848	819	846	803	...	922	852	888	916	...	47	45,215	+ 4,943
New St. Helens and District	903	873	886	882	...	901	889	875	949	...	34	36,891	+ 2,471
Northampton Corporation	678	680	...	...	...	664	661	...	...	...	45	32,402	− 467
Nottingham Corporation	3,565	3,560	3,583	3,592	...	3,623	3,572	3,631	3,654	...	47	182,109	+ 6,188
Oldham Corporation	2,148	2,206	2,146	1,962	...	2,112	2,136	2,281	2,277	...	48	115,905	+ 5,191
Portsmouth Corporation	2,182	2,061	2,189	1,833	...	1,931	1,908	2,046	2,050	...	—	—	—
Preston Corporation	992	982	990	959	...	1,001	1,014	1,040	1,055	...	46⅝	51,835	+ 5,711
Provincial	1,990	1,930	1,964	1,826	...	1,797	1,746	1,803	1,847	...	21	41,328	− 1,604
Reading Corporation	736	722	763	696	...	760	766	805	827	...	47⅛	40,298	+ 3,189
Rhondda Tramways	1,218	1,204	1,173	1,146	...	1,198	1,206	1,236	1,326	...	8	9,624	+ 597
Rochdale Corporation	1,596	1,477	1,467	1,414	...	1,449	1,474	1,526	1,611	...	47½	82,179	+ 1,928
Rotherham Corporation	1,215	1,173	1,225	1,146	...	1,586	1,567	1,562	1,594	...	47½	74,801	+ 18,149
Salford Corporation	4,934	4,993	5,040	4,793	...	4,979	4,683	5,178	5,245	...	46⅜	255,321	+ 8,887
Sheffield Corporation	9,442	9,384	9,501	9,067	...	10,747	10,542	10,678	10,672	...	48⅛	508,960	+ 71,489
Southampton Corporation	1,389	1,387	1,409	1,396	...	1,467	1,463	1,509	1,530	...	46⅜	77,654	+ 7,000
Southend-on-Sea Corporation	573	582	564	562	...	565	578	595	601	...	47	41,576	+ 4,257
South Metropolitan Tramways	*	...	...	...	...	...	...	...	...	...	—	—	—
South Shields Corporation	735	722	714	719	...	794	769	790	801	...	47½	39,630	+ 2,363
Sunderland Corporation	1,482	1,419	1,477	1,446	...	1,520	1,498	1,536	1,547	...	47	77,656	+ 5,709
Sunderland District	565	545	542	575	...	598	589	605	620	...	17	10.623	+ 998
Swindon Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
Torquay Tramways	430	410	402	389	...	375	422	406	457	...	8	3,398	+ 204
Tramways (M.E.T.) Omnibus Co.	*	...	...	...	...	...	...	...	...	...	—	—	—
Tyneside Tramways and Tramroads	509	524	503	489	...	588	604	609	586	...	7	3,831	+ 443
Wallasey Corporation	1,140	1,090	1,106	1,083	...	1,113	1,086	1,107	1,174	...	47⅜	63,321	+ 3,323
Walsall Corporation	906	788	774	663	...	764	729	776	770	...	8	5,743	− 823
Walthamstow U.D. Council	760	756	790	733	...	864	870	894	930	...	47	50,207	+ 8,591
Warrington Corporation	486	470	498	481	...	482	467	475	483	...	47	23,488	+ 1,632
West Ham Corporation	2,979	2,954	3,005	2,882	...	2,869	2,719	2,852	2,924	...	46⅛	148,833	+ 3,987
Wigan Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
Wolverhampton Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
Yorkshire (West Riding)	1,555	1,701	1,515	1,437	...	1,807	1,827	1,742	1,755	...	8	14,177	+ 1,531

* TRAFFIC RETURNS SUSPENDED.

Owing to the European war, the Government have taken over the railways of Great Britain as from August 4, 1914, and the issue of traffic returns has been suspended. Consequently the traffic returns of the electric railways which usually appear on this page cannot be given.

The Publication of the Traffic Returns of the Tramways marked with an asterisk in the above table have also been suspended during the war.

TRAMWAY DIRECTORIES.

A useful feature of this issue is the directory of electric railways and electric tramways which will be found among the advertising pages. This directory contains the names of the chief officials and the principal particulars relating to each undertaking.

THE TRAMWAY AND RAILWAY WORLD

can be obtained, post free, at the following rates :

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"Delivering the Goods"

THIS expressive term has more than usual significance when applied to Daimler Commercial Vehicles. War service has proved that under the most trying conditions the Daimler is to be relied upon absolutely.

Here is a pre-war record from the Crosville Motor Co., Ltd., Chester:

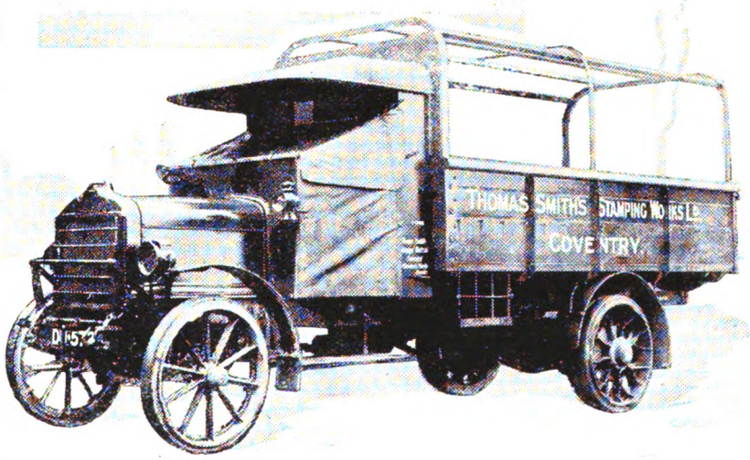
20,000 miles

Repair Bill £2 : 13 : 4

"This vehicle, bought in 1913, has now done 125,000 miles, and is still one of the best in the fleet."

The secret of this success is the Daimler Sleeve-Valve Engine, the finest materials and Daimler craftsmanship.

The Daimler Company Ltd.
COVENTRY



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To Carry 30/45 cwt. & 3½ tons Respectively

"The Design and Construction are Throughout of a Character, which it would be Exceedingly Difficult, if not Impossible, to Improve Upon."

RAILWAY GAZETTE, March 31, 1916.

IN PEACE

USED BY THE LARGEST CARRYING COMPANIES AND COMMERCIAL HOUSES.

IN WAR

USED BY THE BRITISH AND ALLIED GOVERNMENTS.

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It is perhaps a welcome sign of the times that the question of the future of the British motor vehicle industry should be arousing increased interest and controversy as time goes on. The lot of the British motor manufacturer during the war has been both enviable and otherwise. He has been exceedingly prosperous, and, so far as the immediate aspect of things is concerned, has no cause for anxiety. There is, however, a reverse side to this picture. British motor works have been increasing both output and profits at a rate which not even the most rabid enthusiast would have ventured to foretell before the war; but they have been enabled to do this, not of their own initiative, but as the result of a policy forced upon the Government, and through them in turn upon the manufacturer, by the exigencies of the times. In spite of its daily and nightly activity, therefore, the British motor industry has, to all ordinary intents and purposes, ceased to exist. Particularly is this true of the overseas trade, and it must be remembered that in the majority of the distant markets which, prior to the fateful autumn of 1914, were being supplied from these islands, there have been no new restrictions against foreign competitors; and thus the British motor industry has found itself compelled to leave the field to its rivals for a period now approaching three years' duration. It is obvious that the leeway to be made up after the war will be great, and it is to be feared that, to a large extent, British motor manufacturers will have virtually to begin all over again the work of building up the trade in their products abroad. The seriousness of the position must be measured by the actual state of affairs before the war. It cannot be said for a moment that the lot of the British trader in this direction was in any sense an easy one. With very few exceptions he was barely maintaining himself in overseas markets in competition with American, German, and other foreign firms. There was no sign whatever that these conditions would have become improved had events taken a less troublous course; all the indications, indeed, were to the opposite effect, and it was becoming apparent that the efforts required to sell British cars out of their country of origin were sufficiently formidable, and were likely to be more so so long as existing methods remained unchanged. To-day both British and the German manufacturers are eliminated, if for more or less dissimilar reasons, and the American car, in its varying forms, dominates the situation. In fact the American motor industry stands to-day in the position of being all but a monopolist. It has known all the advantages, and practically none of the drawbacks, of the war, and its production figures are such that the output of British works, greatly enhanced as it has been, seems, in comparison, hardly worth considering. It is, of course, pointed out by many that the overwhelming bulk of American production is for home demands, and that the total of exports is by no means so large as one might expect. From this it is argued that American factories will be kept sufficiently busy supplying American purchasers, and therefore that in overseas trade the British maker is sure, at least, of a good "look-in." We cannot, however, be sure that even this very moderately satisfactory state of things will subsist. The United States is a large country, with an immense population, and yet considerable room for expansion. Most of its people, too, are relatively prosperous, but their appetite for motor vehicles cannot be treated as inexhaustible, and a time may come—if it has not, indeed, already arrived—when the output of the motor manufactories of the United States will be more and more in excess of what that country can absorb. When that condition occurs, it will require all the resources of British enterprise to combat it, with or without the assistance of a protective fiscal policy. The latter may be of help in British territory, but in the foreign markets it will, of course, be of no assistance whatever. At the best the British manufacturer will have the entry to such markets on equal fiscal terms to those of his competitors, but there it is to be feared the equality will end. The ascendancy of the American car will not easily be broken down, and most certainly not in the period immediately following the conclusion of the war, beyond which no estimate can at present be profitably made.

* * * * * *

The foregoing may, perhaps, appear to lay undue stress upon the less hopeful aspects, but, as already remarked, it confines itself strictly to the immediately post-war period. With all his recent experience, his resource, and the reputative quality of his productions, one must not expect the British manufacturer to do the impossible, and successfully to attack the present dominance of the American trader within the next two or three years; it is assuredly an unlikely task, if it is not actually out of the question. But there is nothing inevitable in things as they are, and if, in the end, we find British factories assimilating American methods, modifying them to suit their needs, and turning them against their competitors, it will

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MOTOR TRAFFIC.

only be following well-known precedents. It is not possible, in the space available here, to deal with more than a section of a vast problem. Nothing, for instance, has been said as to our own home trade in motor vehicles, and the policy of the State and of the manufacturer concerning it. One thing is certain, however, and that is that even in the inconceivable event of total prohibition of imports, the needs of the British Isles are insufficient to absorb more than a proportion of the output of our motor works. It would appear, therefore, that the question of protection for motor manufacturers cannot be a deciding factor. It will have to be considered, first and last, as must the whole future of the motor trade, as a means to an end—that end being the development of external markets.

* * * * * *

Observation of traffic, particularly in London, makes it quite clear that the use of trailers is materially extending. Especially does this apply to long-distance and heavy haulage, and of vehicles to be seen daily in the metropolis and elsewhere that have obviously travelled considerable distances. Steam wagons and trailers are notably prominent. No doubt in some degree the ever-increasing difficulties of railway transport are the cause of this development. A steam wagon and a trailer is perhaps the nearest approach one can get in terms of motor transport to railway haulage, i.e., when more or less heavy loads are involved. The speed limit of five miles an hour to which vehicles with trailers are restricted is, of course, somewhat of a handicap, but it is one that counts for little now-a-days, when the problem so often is not that of getting loads moved in a minimum of time, but of getting them moved at all. It is just these heavy and bulky loads that are most affected by the prevailing railway congestion, and in respect of which the provision of some alternative economic method of transport is so urgent. This in itself would account for the additional numbers of trailers now to be seen on the roads. To some extent, however, that fact represents a more or less normal development, quite apart from any exigencies of the war. It must be remembered that the great advantage of motor transport is economy. It is upon that it has had to rely for its progress in the past, and it must continue to do so in the future. Speed in itself is quite a secondary consideration, and is of little importance except in so far as it affects the question of cost per ton-mile. The trailer, by increasing the useful load that may be hauled by either a steam or petrol lorry, affords the means whereby that ton-mile cost is kept at its lowest. So that we may take it that the problems and necessities of the war have done no more than to hurry forward a practice that was bound to extend, in any case, and the future will probably see a considerable increase in the proportion of heavy motors to which trailers will be attached. No doubt these will be mainly confined to vehicles engaged on fairly long distance commercial work. But there is plenty of scope for economy in this direction in municipal services, in which waste of mileage has always been rather pronounced. An interesting example is supplied by the Westminster City Council, who couple trailers to both steam wagons and petrol vehicles for dust collection. This has enabled the Council to meet the present shortage of labour far more successfully than could otherwise have been the case, as it materially assists in keeping the vehicles fully employed, and reducing to a minimum the time spent by both men and lorries in going to and from the depot, and in standing there for unloading. With a 3-ton petrol vehicle and trailer, total loads of 5½ to 6 tons are quite common, whilst with the 5-ton steam wagons up to 9 tons can freely be dealt with on a single haul. It is true that this method in dust collection can only usefully be adopted in certain given conditions—not for ordinary residential house-to-house work—but these conditions or others analogous are fairly common, so that the total scope for economy on these lines is not inconsiderable.

AN IDEA FOR RAILWAY COMPANIES.

Loaded Motor Parcels Traffic by Special Trains.

The suggestion has been made in an article published in the *Journal* of the Great Central Railway Company that it would be to the benefit of railway companies and public and private carriers of parcels by road motors if special trains were provided for the transport of loaded motor parcels traffic. The writer says, in part:

"The particularly quick transit given by motor parcels van is often costlier to provide than the slight additional work devolving on the railway companies in catering for parcels traffic. Nevertheless, it pays in the long run big houses like Harrods, Whiteley's, Army and Navy Stores, to deliver by motor, in the afternoon, goods whose orders were received by the same morning's post. That big stores are commencing to deliver goods per railway 'carriage paid' to any part of the Kingdom shows the traffic can well bear the railway rate.

"What the traffic needs is a really expeditious service, and, that traders are willing to pay the higher cost for quicker deliveries than the railways give, is proved by the fact that the more expeditious service by motor car involves heavier expense than transit by rail.

"Why should not the railway companies, on the principle that half a loaf is better than none, offer their services to the motor owning companies and perform for them the purely railway function of the 'long haul' portion of their work at a price a fraction below the present cost to the motor companies? The work would pay the railway companies, seeing that their general expenses of rates and taxes, etc., are constant, and the traffic would be a pure addition to revenue. The extra use made of the permanent way by the additional traffic, would be something to set against these taxes. My argument is this: That part of transport work which costs the motor companies most, costs the railway companies least. So a well arranged co-operation to a certain reasonable extent would benefit both. The railways have everything to gain by co-operation, as the idea would turn their competitors into auxiliaries.

"It is the long hauls over the country roads that wear out the costly tires of the motors, while the actual running costs are the least part of the expense to the railways in connection with other than passenger traffic. The terminal handling and clerical work which is the most costly and the least profitable part of the railway's work, can be performed and is performed by the motor companies more expeditiously and cheaply than the railways do it, and the fact will in time be generally recognised by the railway companies.

"If a special train could run on certain days at a suitable hour for the delivery motors of several of the big London stores between certain stations, a satisfactory rate could no doubt be arranged. It would have to work out at not less than 3s. per mile. It would be practically wagon-load rate by special train. It is a matter for consideration whether smaller engines of an economical type (if not steam, then electrical) cannot be built which would enable the railway companies, whose line capacity allow of it, profitably to do the purely haulage work of a single loaded motor car at a rate a trifle below the cost of motor haulage by road.

"The actual costs of long distance road transport can always be definitely ascertained, and theoretically the railways should never refuse to cater for the traffic at just a trifle below this figure. It might be possible to attach a suitable vehicle to convey loaded motors on certain of the passenger trains. If the motors have to make intermediate calls, it could be arranged to convey them one journey by passenger train at an agreed rate. It would be necessary for the big firms to work hand in hand with the railways and contrive to systematise their parcels to meet the conditions of railway transit.

"This idea presents, if it does not altogether solve, one of the most up-to-date problems before the railway management, and railway companies will either have to meet it or let the opportunity slip. If they wait until the fast approaching day comes when the

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MOTOR TRAFFIC.

recent invention of manufacturing rubber at 1s. a pound becomes commercialised, road motor transport firms will ignore the cost of tires and be able to do even the haulage part of their work as cheaply as the railways.

"It might be mentioned that on the G.N. of Scotland Railway some of their own goods motor wagons are run down the line by train and then start on a delivery route from the most convenient station.

"What has happened abroad, is reasonably bound to come to pass in this country. In America express companies deal with the 'smalls' traffic and the railways simply haul their cars. The 'spediteurs' of Germany performed the work of collection and handed the traffic to the railways in wagon loads." B.

INSTITUTION OF AUTOMOBILE ENGINEERS.

Daimler Premium for Graduates.

Beginning this year, 1917, and continuing until further notice, there will be awarded at the discretion of the Council of the Institution of Automobile Engineers, in addition to the graduates' prize offered each year, a premium of £25 to the graduate who submits the best paper on an appropriate subject in any session. Papers must reach Mr. Basil S. Joy, the secretary of the institution, during the month of September in each year, and the award will be made known during Christmas week in each year.

This annual premium has been placed at the disposal of the Council by the Daimler Company, Limited, of Coventry, and its scope and purpose are indicated in a memorandum from the company's chief engineer, Mr. A. E. Berriman. When possible, arrangements will be made for the premium paper to be read at an ordinary general meeting of the members, as indicated in paragraph 10 of the memorandum. The attention of graduates desiring to compete is drawn to certain matters of detail mentioned in paragraph 15, and it should also be clearly understood that papers already read at graduate section meetings may be submitted in accordance with paragraph 15.

Mr. Berriman's memorandum is as appended: —

The Daimler "Premium" for Graduates of the I.A.E.

1. The Daimler Company has placed at the disposal of the Council of the Institution of Automobile Engineers an annual premium of £25 to be awarded as a cash prize to the graduate who submits the best paper on an appropriate subject.

2. The award will be made only when the paper is of sufficient merit, but the quality of competitive contributions will be judged on a very broad-minded basis, in order that the majority of graduates may have a reasonable chance of attaining the standard required. In principle, the award will not be made unless the paper is of sufficient merit to be worthy of being read and discussed before an ordinary general meeting of members.

3. This premium is not intended primarily as a reward for original work such as can only properly be expected from senior members of the Institution, but rather as an encouragement to graduates to cultivate qualities that will be of practical use in their daily life.

4. It is recognised that comparatively few graduates who participate in original research will have the right to publish data of special importance thus obtained. It is not from the point of view of the novelty of their contents that the merit of competitive papers primarily will be judged, although it stands to reason that the actual presence of this quality must throw great weight in the competitor's favour.

5. Graduates are supposed to be students of the work of senior men, and it is in the study and appreciation of such work that all graduates may legitimately find material for the preparation of really useful contributions to the knowledge of their own class, and others besides. It is mainly from this standpoint that competitive papers will be judged for merit.

6. In the preparation of a paper, a graduate should bear certain objects clearly in mind. In the first place he should write for others of his own grade, and he should write to help rather than to lay down the law or to voice his opinion. Above all other defects, the papers of most junior men suffer from a plethora of opinion and an absence of adequate grounds in support of it.

7. There are two stages in the acquisition of knowledge—assimilationand expression. None can be sure he has learned anything until he has succeeded in expressing it either in material work or in writing. It is the object of learned societies to encourage the latter form of expression, and it is the object of the Daimler premium to impress on junior minds the fundamental significance of the above stated truth. Every graduate ought to try to win this premium, because it is specifically within the capacity of each to prepare a paper of sufficient merit before he leaves this class.

8. In the assimilation of knowledge the first requisite is good reading. Many people write better than they read, and sometimes their fluency runs into nonsense. In good reading it is necessary to distinguish between fact and opinion, and it is important to remember both. In the study of any subject the first step is to find out what is already known and what is already believed by competent authority. Properly pursued, this is a more fascinating occupation than the improvisation of nebulous ideas, and its results are infinitely more valuable.

9. Having obtained and recorded the available data, the next step is to express it clearly and succinctly in suitable language. This is a labour involving far more effort and practice to make perfect than is commonly supposed by those who have not tried to write. It is so much too easy to use many words that boil down to nothing under the heat of criticism. It is so difficult to see the essential point, and to make its position and its importance stand out clearly by the careful layout of its environment, but to succeed in so doing is original work of its kind, and serves a most useful purpose.

10. When well done, work of this character is capable of serving such a very useful purpose that it is quite worthy of the attention of all grades of the Institution, and whenever possible arrangements will be made for the premium paper to be read at an ordinary general meeting of the members. Moreover, recognised authorities on the subject of the paper will be specially invited to attend and to supplement the graduate's paper by personal contributions to the discussion. In this way it is hoped that the Daimler premium paper may become an annual meeting of high interest to all concerned, besides an occasion of great credit to the successful graduate. His interest, indeed, will go beyond the prize, for it is part of the scheme that he shall have an opportunity of becoming personally acquainted with some of the leading men in his chosen subject.

11. In order to write a good paper on the lines indicated, a graduate must search beyond the confines of his own library and the text-books of his college days. This in itself is a valuable training, because it teaches resource in seeking, encourages concentration in reading, and promotes logic in thinking. Moreover, the opportunity of looking at a book sometimes occurs only once, and it is a valuable asset to have acquired the habit of making a few very salient notes that are suitable for subsequent quotation with full references. It may take months to collect these little bricks of information, months to study their meaning, and months to build them into a habitable house of knowledge, from the windows of which one may look out intelligently upon each of the many aspects of the surrounding field of labour. It is this thorough appreciation of established facts, and thoughtful consolidation of considered opinion, that alone can provide a domicile in which to create and nurture the sound original work that it must be every engineer's ambition ultimately to give to his world.

12. It is an old adage that what is worth doing at all is worth doing well, and technology of all things is not only worthy of, but demands good style in its expression. Lucidity is the first criterion of technical writing, and having regard to the purpose of the Daimler premium paper, style will count equally with matter in judging merit. One of the practical uses of writing papers is the training it affords in writing technical reports and a technical report that is not clear can do little good and may do much harm to those who try to use it. Logical sequence in the presentation of facts and ideas is the principal requisite to lucidity in technical writing, and brevity comes next in importance. These qualities are seldom to be obtained offhand at first attempts even by experienced writers. Frequent correction and re-arrangement are necessary before the final result affords a worthy setting of the central idea, and it often happens that one's perception of the truth will undergo surprising changes in this process of synthetical thought. It is because of this that such work should always be undertaken in a receptive attitude of mind that is prepared to see flow a new stream of reason from the rock of fact.

13. Technical writing should be distinguished from fiction, not only by the character, but also the arrangement of its text. In fiction it is part of the scheme to lead the reader to the unknown climax through a maze of detail. In technology the reader should always first be told the conclusion, in order that his mind may be attuned to follow the subsequent reasoning. It is this summing up of the net result that taxes the resources of the mind and its vocabulary, and oftentimes, too, breaks up the shell from which it has thus laboriously been hatched.

14. The consequences of a collapse of the detail structure are less disheartening if short, self-contained paragraphs have been employed in its construction. If each paragraph says something definite it will be much more readily used again after the crash. If its contents are still true, the paragraph as a whole may be found a suitable berth in some other position, if no longer true, it may be the more readily rejected. When long sentences, replete with the embellishment of discursive ideas, are thus broken, it is a laborious business to sort out the bricks from the mortar.

15. In order to facilitate the work of the judges, all papers must be typewritten on foolscap paper with a 1½ in. margin. The typing is to be single spacing, with double spacing between paragraphs. Graphs must be prepared on squared paper cut to foolscap size, and the full chart must also leave a margin of 1½ in. on the left for binding. If a chart essentially requires more space the sheet must be folded to foolscap size in such a way that it opens readily when bound. The titles and any text embodied on the graphs are to be typed on plain paper and pasted in place. The text, followed by the graphs and drawings, are to be bound in a folder. Papers that have already been read at graduate section meetings may be submitted without prejudice, and such papers may be altered if desired. It will also be permissible for the prize-winning paper to be altered, with the Council's approval, between the date of its selection and the date of its reading. Notification of the award, together with the announcement of the date of the meeting at which the paper will be read, will be made in Christmas week each year.

"Factories—Their Building and Organisation."

A meeting of the London graduates of the Institution of Automobile Engineers was held on February 22, when a paper on "Factories—Their Building and Organisation" was read by Mr. H. O. Blackford.

The author first dealt with the question of suitability of site, and went on to emphasise the necessity for forethought in planning a factory with a view to possible extensions rather than, as is often the case, extending merely in the line of least resistance. It was also desirable to eliminate the unnecessary conveying of parts from one end of the factory to the other, and this could best be done by methodical planning of the shops. As far as possible a works should be mapped out with each of the shops carefully designed for its individual requirements, and its arrangement in relation to its immediate neighbours should be such that a minimum of labour is required in moving parts from one operation to another.

The second part of the paper dealt with the question of the staffing of factories. Special attention was given to the consideration of apprenticeship systems, a plea being made for more careful placing and supervision of apprentices. The main staff was then discussed, and the author strongly advocated the establishment of an active technical board (apart from the board of directors), specially appointed to meet at frequent intervals to check and consider the various details of the concern. This board should include representatives from all departments, including buying and selling. The importance of smooth working between departments, such as the shops and the drawing office, was emphasised, and attention was drawn to the importance of the sales department and its function as the link between the works' production and the public.

The duties of the chiefs of the various departments were briefly outlined, and the author concluded with a reference to the necessity for specialising on output on a large scale in this country. The conclusion of the war would provide an opportunity of turning over a new leaf, much too valuable to be lost.

MECHANICAL TRAINING FOR BOYS.

A systematic course of training is offered to boys from sixteen to eighteen years of age at the shops of the United Railways Company of St. Louis, Mo. Each apprentice furnishes his own tools, but the company provides tool-boxes. The length of the course is four years. At the beginning the pay is 6d. an hour, and this is increased at the rate of ¾d. per hour every six months. Every apprentice must attend school at least two nights a week in conjunction with his instruction in the shops. This gives the necessary training in mathematics, drafting and applied science, the course being arranged by the company's engineers in conference with the school authorities. The tuition is paid by the railway company.

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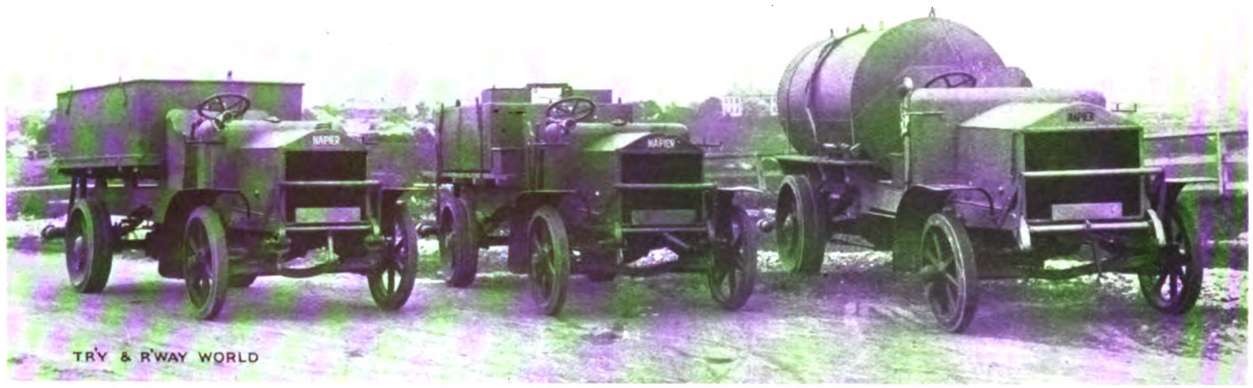
MOTOR TRAFFIC.

NAPIERS AS WATERING VANS.

The importance that is attached to street watering and cleaning in a hot country adds additional interest to the choice of the motor chassis upon which the tank body is placed. Each of the three machines shown in the appended illustration is a Napier, which both as a private car and as a business vehicle has become exceedingly popular in Australasia. The three tanks are removable, when the chassis can be used for other departments of municipal service. These Napiers are the property of the Brisbane (Queensland) Council. British car manufacturers will congratulate D. Napier and Son, Limited, upon the popularity that their products have attained under the arduous conditions prevalent in Australia, where keen competition has to be encountered from American makers.



Napiers in Municipal Service in Brisbane.

LOAN OF DAIMLER OMNIBUSES.

To enable the postal authorities at Coventry to cope with the enormous increase of work during the Christmas season, the Daimler Company, Limited, very considerately loaned two service omnibuses for a few days, while certain works were closed for the holiday.

The omnibuses, which are illustrated on this page, have been used daily for the past two years on a double journey between Coventry and Birmingham carrying munition workers to and fro. Some of these passengers are seen in the photograph.

Daimler Omnibuses Loaned to the Post Office.

500 TRACTORS FOR THE FARMS.

Sir Arthur Lee, head of the Food Production Department, set up in consequence of the submarine peril, announced on February 27 that 500 motor tractors are expected from America. Those already arrived were being let out to the farmers, and by using acetylene lamps it is hoped to work twenty hours out of the twenty-four. As it is only possible to sow in time for this year's harvest up to April 15, it was hoped that motorists and others willing to volunteer for night work would send their names to 72, Victoria Street, London.

Mr. Perry, the managing director of the Ford motor organisation for Europe, is giving his services in collecting and manning tractors. An appeal by Mr. Perry to owners of motor vehicles suitable for use as tractors to lend them to the State had produced over a thousand offers on March 1, but more were required for whole or part time work up to May 1.

It is stated that Mr. H. Ford has decided to erect and equip works in Cork, Ireland, for the manufacture of farm tractors, bringing the material from the United States.

The Prime Minister on March 2 received a cablegram from Mr. D. J. Johnston, of the Canada Nitro Products, Limited, Toronto, presenting to the nation in aid of their agricultural work 100 farm tractors of the type considered the most efficient yet designed in America. The gift includes harrows, binders, and other implements. A skilled mechanic will accompany each tractor. Mr. Lloyd George has replied gratefully accepting the generous gift on behalf of the nation.

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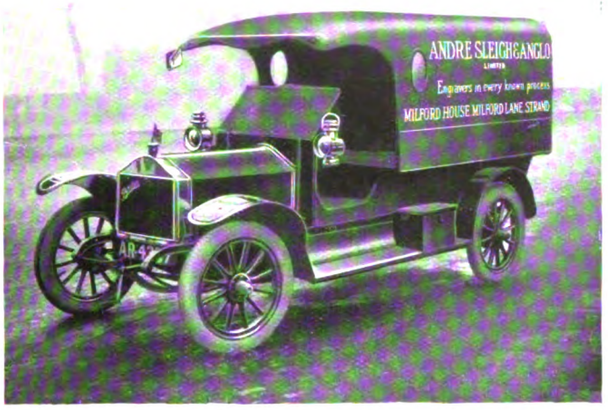
MOTOR TRAFFIC.

A BRITON COMMERCIAL CAR.

Messrs. Andre Sleigh and Anglo, Limited, recently purchased from the Briton Motor Company Limited, of Wolverhampton, the 14–16 H.P. car illustrated below. The car has a carrying capacity of 15 cwt. and is fitted up with five detachable wheels, 810 by 100,



heavy grooved tires all round, including the fifth wheel and fifth tire, and includes five lamps, two gas head lamps and three oil lamps, two side and one tail, horn, pump, and all tools.

The chassis price is 240 guineas, and the latter includes the five detachable wheels and tires, wings, running boards, dash, bonnet, petrol tank and pipes, all tools, pump and jack. The engine has four cylinders, cast in pairs; water-cooling is by gear-driven pump, with fan to encourage draft. Zenith carburetter is fitted, and variable ignition magneto.

The car has been in use for two years, and has done on an average 70 to 80 miles a day, carrying from 9 to 11 cwt. The owners state that it has cost very little for repairs.

SHELL MARKETING COMPANY have a contract to supply about 1,040 gallons of Shell II. motor spirit during six months to the Cleansing Committee of Manchester Corporation, at an approximate cost of £130.

NEW PETROL DEPARTMENT.

INVESTIGATION OF HOME SOURCES OF SUPPLY.

The Minister of Munitions has established a Munitions Petroleum Supplies Branch, of which Mr. E. Houghton Fry will act as director. One of the objects of the new branch will be to raise the output to the limit of capacity and so ease the demand upon shipping space. For months past the Government have virtually controlled the importation of lubricating oils, and it is now proposed that the supplies of illuminating, gas, and fuel oils, especially for firms engaged upon Government work, shall come under the direction of the new body. Motor spirit, so far as required by Government contractors, will also be regulated.

Sir Boverton Redwood will have charge of the research section, including the development of the British sources of supply, most of which is from Scotland. Sir Boverton, who has been honorary adviser on petroleum to the Government for many years, has stipulated that he is to receive no payment for his services.

Professor John Cadman, president of the Institute of Petroleum Technologists, will assist in the organisation of arrangements with the Scottish shale distilleries, with a view to a considerable increase in their output.

Sir George Beilby is also assisting in an advisory capacity.

An important announcement was made on February 4 at the second annual dinner of the Coke-Oven Managers' Association at Leeds, when Lord Moulton, the Director-General of the Explosives Supply Department of the Ministry of Munitions, was to have been present, but was prevented by illness. It was stated that the increase in the output of toluol and benzol during the past twelve months had been astonishing, and that it exceeded any estimate ever made.

COTTAGES FOR DENNIS BROS'. EMPLOYEES.

On account of the great increase in the number of their employees, Messrs. Dennis Brothers, Limited, the commercial and municipal motor vehicle manufacturers, have been obliged to erect a considerable number of cottages to accommodate the men and their families. For this purpose the company purchased land on the outskirts of Guildford, and have built cottages on most up-to-date plans. Externally the dwellings—a group of which is shown in the accompanying photograph—are of plain design, but the interiors afford every convenience. Moreover, the cottages are let at a very moderate rent, so that both the employers and the employed are benefited as the result of the company's enterprise.

Solution of the Housing Problem by Dennis Bros'. Ltd.

GLASGOW TRAMWAYS COMMITTEE are obtaining tenders for a battery-propelled road vehicle.

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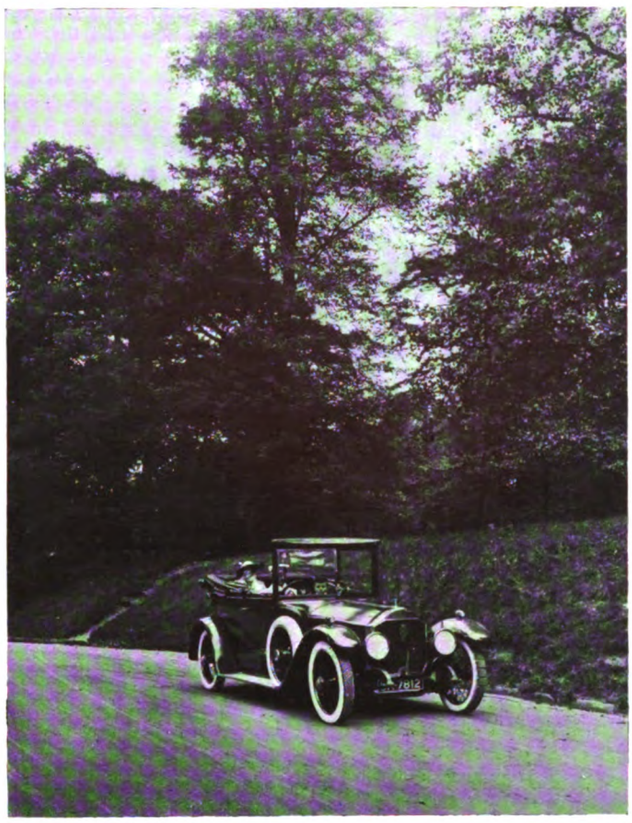
MOTOR TRAFFIC.

A NAPIER FOR TOWN SERVICE.

The handsome motor car shown in the accompanying view taken last autumn on Hampstead Heath is a 30/35 H.P. 6-cylinder Alpine model Napier. It is fitted with a well-designed Pullman saloon, so arranged that it opens from the front V-shaped screen and lies



flat back as shown in the picture. The saloon was built by the Cunard Motor and Carriage Company, Limited, of Putney, and is likely to be a popular model in happier times. This Napier model is admirably suited for town carriage, owing to its silent and smooth running, but it is capable of making the longest journey with the greatest comfort to passengers.

MOTOR VEHICLES FOR MUNICIPALITIES.

MARGATE COUNCIL have agreed to purchase a motor fire engine for £1,050.

MORLEY COUNCIL are considering the question of purchasing a motor wagon.

BOLTON COUNCIL have placed an order for a battery-propelled tipping wagon.

LEYTON COUNCIL have purchased a battery-propelled wagon for refuse collection.

CHELTENHAM COUNCIL have ordered an Orwell electric vehicle from Messrs. Ransomes, Sims and Jeffries, Limited, at £924.

MANCHESTER CITY COUNCIL have purchased a 2-3 ton Austin tipping wagon for the Lighting and Cleansing Committee from the Austin Motor Company, Manchester, at £747 17s.

SUNDERLAND COUNCIL have decided to purchase a second motor fire engine, thus enabling the brigade to dispense with two horses and a steam engine, and effecting a saving of about £72 per annum.

BEDWELLTY BOARD OF GUARDIANS have purchased a motor car for the conveyance of the members to relief committees and the official staff to committee meetings, in consequence of the restriction of the train service.

SALFORD COUNCIL have purchased a Halley chassis at £725, for conversion into a motor tower wagon for the tramways department. The machine, which was obtained locally, also includes chars-a-banc and lorry bodies. For the gas department a 3½-ton Sentinel steam wagon has been obtained, at £780. It has hydraulic end tipping gear and rubber tires.

EDISON TOWER WAGON FOR CROYDON.—With a view to facilitating overhead work on the tramways, Croydon Corporation have agreed to purchase an Edison battery chassis with charging gear, etc., at £921, for use as a tower wagon. The amount will be defrayed out of the reserve and renewals fund. The cost of running the wagon is estimated at £21 per annum, and the purchase will enable the department to dispense with the use of a horse.

MORE BATTERY OMNIBUSES FOR LANCASTER.—The Corporation on February 28 agreed to purchase two or more battery-propelled omnibuses of British manufacture, in order to cope with the demand for passenger transport. The tramways department are already operating two Edison omnibuses, and the chairman of the committee stated that he believed the time was coming when it would pay the Council to scrap the electric tramways and to substitute electric omnibuses.

SURBITON COUNCIL have informed Edison Accumulators, Limited, that if the Local Government Board do not permit the Council to purchase the two wagons for refuse collection by instalments they will purchase one vehicle for cash and take another for hire for twelve months from April 1 next, upon the understanding that the Council will purchase the vehicle for the sum named in their specification at the expiration of twelve months. The makers have accepted this arrangement. The hire for one year (£60, or 6 per cent. on the outlay) will not be deducted from the purchase price.

A NAPIER ON THE BORDERS OF ALBANIA.

The condition of the roads in Greece have never been good, and at the present time, owing to the movements of large forces, they are in a worse condition than usual. Only a car built to comply with the most strenuous conditions could hope to cope with the present state of affairs in that country. Bridges are non-existent in many quarters, and the only means of progression is by fording the many rivers that abound. The accompanying photograph shows an extra strong Colonial Napier fording the River Limni, on the borders of Albania. It will be seen that the car is submerged to a considerable depth, but thanks to the special attention paid

to this overseas Napier model, it is possible to negotiate the fords of the rivers without difficulty. It is well known that the extra strong Colonial Napier is a prime favourite in our Colonies, and it is pleasing to think that the same model renders efficient service in European countries where the road conditions are not of the best.

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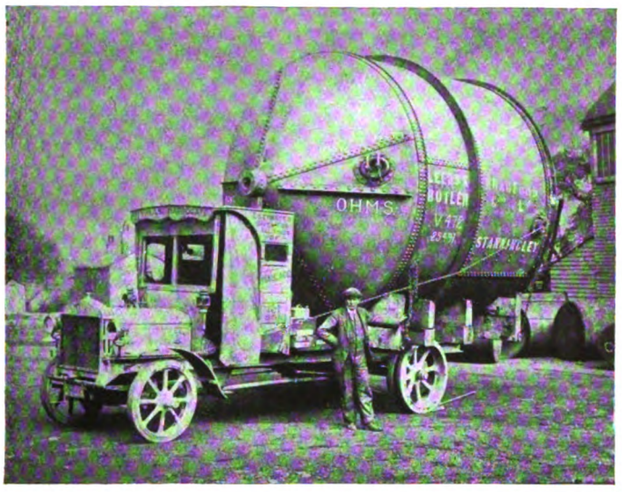
MOTOR TRAFFIC.

NOTABLE SERVICE BY A KARRIER.

The two illustrations below represent Karrier lorries owned by Messrs. Albert Hymas, builders, stone merchants, and haulage contractors, of Harrogate. The first photograph shows a Karrier lorry delivered to the firm on November 8, 1913. It is a 5-ton 40-H.P. chain-driven vehicle with a four-speed gear box.



As shown in the photograph, this vehicle is loaded with a huge tank, approximately 15 ft. in diameter, and weighing over 5 tons. The plain lorry body usually fitted has been removed and wood chocks fitted to the chassis to take this special and unusual load. The height of the load demanded considerable care and skilful driving to pass through narrow and crowded streets where clearance between tramways and pavement is very limited. Strength of chassis and easy control were also essential.

A considerable number of these unwieldy tanks were taken over a journey of something like 70 to 75 miles each way. The work

was done economically and there was not one mishap. This firm has a steam wagon, but preferred to utilise the Karrier petrol lorry, for although low gear had to be used considerably when passing through busy streets, the work done by Karrier took less time than with a steam wagon.

Messrs. Hymas have had much consistent good service from their first Karrier lorry. After waiting some time to obtain delivery of another Karrier (and this regardless of the early deliveries of other makers), they placed an order for a new W.D.S. type Karrier, 4 ton-load capacity, with Messrs. Clayton and Company, of the Karrier Works, Huddersfield. Owing to another customer being unable to get sufficient petrol granted him to run three Karriers, Messrs. Hymas bought one of the three direct through Claytons. This latter vehicle is shown in the second photograph.

The driver seen in the first picture learnt his driving in the first Karrier purchased by Messrs. Hymas. Previous to that, he had had no motor driving experience of any kind.

OMNIBUSES WITH VESTIBULES.

The Belsize Motors, Limited, have supplied two types of single-deck omnibuses to the British Automobile Traction Company, which is associated with the British Electrical Federation, and is running a large number of services in the provinces as well as on agreed routes in the Metropolis. By means of this company's vehicles several provincial tramways are linked up with the surrounding districts and in a number of localities the public are indebted to the British Automobile Company for their sole means of rapid communication. Both double and single deck vehicles are used. With the latter an improved type of body is utilised, giving a

vestibule in which the driver is completely sheltered from the weather as shown in the accompanying illustration of one of the Belsize omnibuses.

DENNIS FIRE ENGINE CATALOGUE.—A new publication of interest to all local authorities and to owners of extensive works, has been issued by Dennis Brothers, Limited, of Onslow Works, Guildford, from whom copies may be obtained. Its 42 pages describe and illustrate the Dennis turbine motor fire engine (used ashore and afloat) and the other departments of fire extinction work to which motor traction has been adapted. The illustrations are produced in colours, and in addition to turbine machines in their several forms there are pictures of a 45-H.P. special rescue tender and a 30-H.P., 30/40 cwt. special fire brigade general utility van. These machines are in use in the London Fire Brigade, the former carrying four or more men and smoke helmets, dynamo equipment for search-light, electric blower, hand lamps, water lights, etc.

MESSRS. CLAYTON AND COMPANY, HUDDERSFIELD, LIMITED, Karrier Works, Huddersfield, tell us they have in print two very interesting publications. One describes the Karrier's hill-climbing abilities. The other is a descriptive folder dealing with the chain-driven vehicles made by this firm, and a series of photographs showing some of the Karriers which Messrs. Clayton have made and delivered during the past few years. Owing to the high price of paper and the cost of blocks and printing, these publications are necessarily limited in size, but they are none the less interesting, a considerable amount of useful information having been got into a small compass. The firm will be pleased to send both folders to anybody who makes a request for them; just a post card will do. Every driver, foreman, garage manager, in fact, everybody interested in public service and commercial transport, should send his name and address to Karriers, to be filed to receive the different kinds of booklets, folders, post cards, etc., which the firm issues from time to time.

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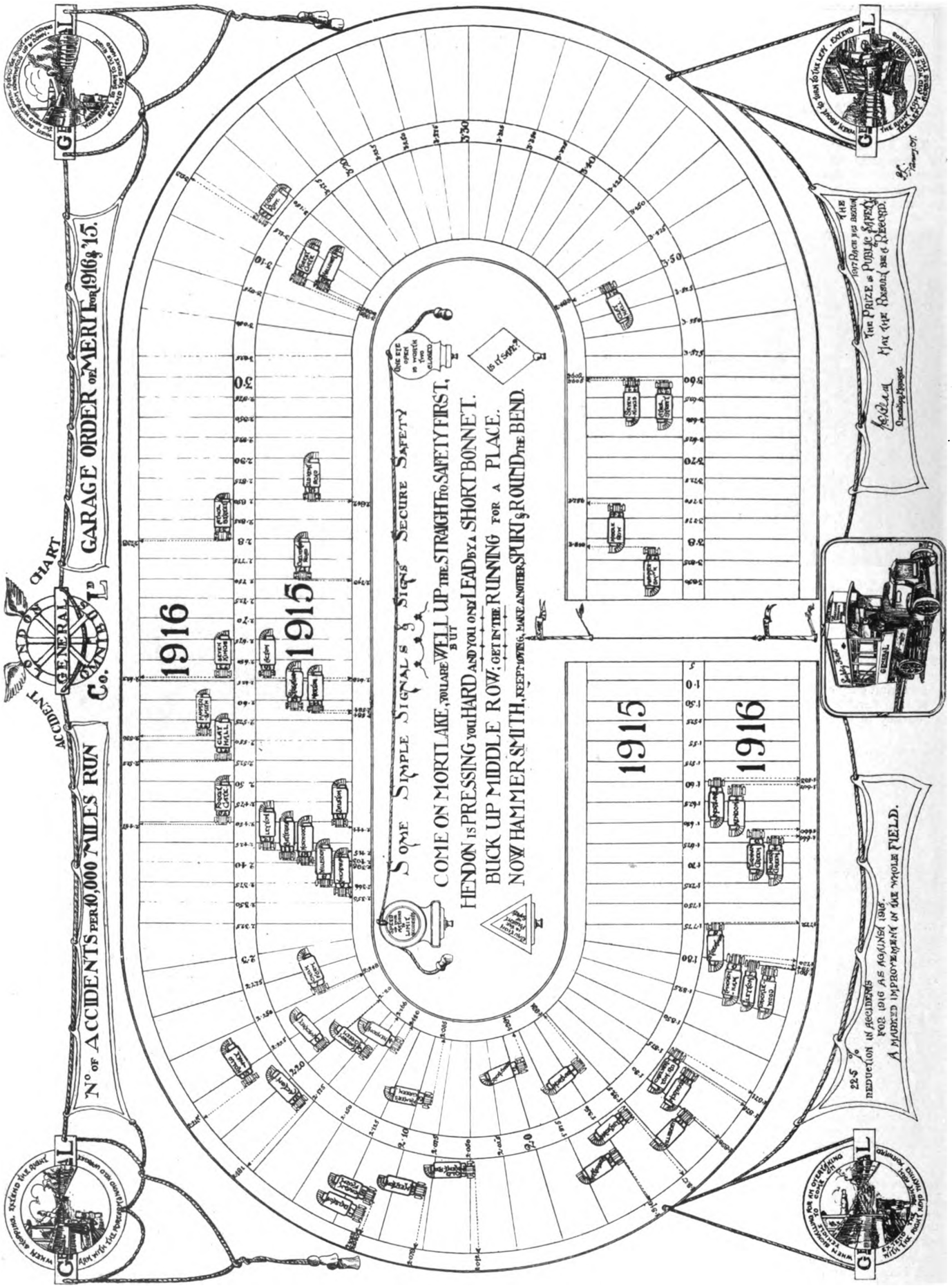
LONDON GENERAL OMNIBUS CO. LTD
ACCIDENT CHART
GARAGE ORDER OF MERIT for 1916 & '15.
Nº OF ACCIDENTS PER 10,000 MILES RUN
1916
1915
SOME SIMPLE SIGNALS FOR SECURE SAFETY
COME ON MORTLAKE, YOU ARE WELL UP THE STRAIGHT for SAFETY FIRST, BUT
HENDON IS PRESSING YOU HARD AND YOU ONLY LEAD BY A SHORT BONNET.
BUCK UP MIDDLE ROW; GET IN THE RUNNING FOR A PLACE.
NOW HAMMERSMITH, KEEP MOVING, MAKE ANOTHER SPURT & ROUND THE BEND.
1915
1916
22·5 % REDUCTION IN ACCIDENTS FOR 1916 AS AGAINST 1915.
A MARKED IMPROVEMENT IN THE WHOLE FIELD.

Chart Showing Number of Accidents per 10,000 Miles Run and Garage Order of Merit for 1916 and 1915, issued by London General Omnibus Company.
A Reduction of 22·5 per cent. is Indicated.

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MOTOR TRAFFIC.

WOUNDED SOLDIERS ENTERTAINED.

LONDON OMNIBUS COMPANY'S OFFICE STAFF AS HOSTS.

An interesting gathering of wounded soldiers and girls of the London General Omnibus Company's office staff took place recently at the Central Hall, Westminster. A committee of the office staff had been previously formed and funds raised by means of a dance held at Chelsea Town Hall, the proceeds of which were devoted to an entertainment and tea for "the lads in hospital blue."

The operating manager (Mr. H. E. Blain) opened the afternoon with a few words of welcome, with the general superintendent

For the Lads in Hospital Blue.

(Mr. J. P. Thomas) in the chair. The programme of excellent music was arranged by members of the staff. Later in the afternoon Miss Laura Evans-Williams, Mr. J. A. Meale, and Mr. Haydn Wood gave selections from their repertoire. The tea room was beautifully decorated, and the smartly-attired waitresses—all members of the staff—carried out their duties with ease and grace.

A feature of the afternoon was a hair-dressing competition, 20 soldiers arranging the toilettes of 20 of the staff. Sergeant Williams, of Millbank Hospital, won the first prize—a silver cigarette case—which was presented to him by Mrs. J. P. Thomas. A most enjoyable time was spent, and after passing a vote of thanks to their hosts, the guests left by the L.G.O. vehicles for the hospitals.

FEWER MOTOR VEHICLES IN USE.

The number of motor cars, motor cycles, and commercial motor vehicles now in use in the United Kingdom is 331,897, compared with 536,747 in 1914. These figures are stated in the *Car*, which prints the complete census taken by Lord Montagu for 1915 and 1916.

The number of motor cars fell from 281,175 in 1914 to 137,066 in 1915, and last year it was 150,249. Commercial motors, which numbered 22,191 in 1914 and 15,656 in 1915, now number 21,358. Motor cycles fell from 233,381 in 1914 to 147,904 in 1915, and the total is now 160,290.

The decline on the outbreak of war was due to the impressment of cars by the Government, the laying by of vehicles by their owners "for the duration of the war," and the voluntary offers of vehicles—many of which are still in France—to the Government for service either at home or abroad.

It is believed that not 20 per cent. of private vehicles are now used for other than absolutely essential or national work. Many owners have given up their large, luxurious cars to hospital work, and are using cheap American machines for their own purposes.

VARIABLE SPEED GEARS FOR MOTOR ROAD VEHICLES.—The Institution of Mechanical Engineers has published the paper dealing with the above subject, read by Mr. R. E. Phillips at a recent meeting of the Institution. Exhaustive treatment is given to the subject in the paper, and its interest is enhanced by a report of the discussion, which was taken part in by a considerable number of experts, including Dr. H. S. Hele-Shaw and Mr. Thomas Clarkson. Mr. Phillips has been awarded the "Starley Premium for 1917" for his paper, a copy of which may be obtained by any of our readers on application to him at 70, Chancery Lane, W.C.

MOTOR TRAFFIC NOTES.

NO IRON FOR DANGER SIGNS.—The Automobile Association have informed Shanklin Urban Council that they cannot at present give any more danger signs for erection on the roads, as iron is not obtainable for that purpose.

LONDON OMNIBUS RECEIPTS.—What with the reduced railway facilities and the reduction in the number of motor omnibuses consequent on the war, the daily receipts per omnibus have risen, it is understood, to £6 10s. from about £4 10s. prior to the war.

ELECTRIC LORRY FOR AN OLDHAM GOODS YARD.—The Lancashire and Yorkshire Railway Company have introduced an electric lorry in the Royton Goods Yard, Oldham. The Corporation Electricity Committee have arranged terms for charging the vehicles at night.

OPPOSITION TO MOTOR OMNIBUS BILLS.—Monmouthshire County Council have decided to lodge petitions against the Bedwas and Machen Council Bill, the Caerphilly Council Bill, and the Ebbw Vale Council Bill, each of which asks for powers to provide and operate motor omnibuses.

C.M.U.A. AND LONDON HOSPITALS.—The general committee of the Commercial Motor Users' Association has placed the sum of £100 per annum at the disposal of their chairman, Colonel R. E. Crompton, for allocation, in five sums of £20 each, to the general funds of five London hospitals.

SERVICE ROAD MOTOR FOR TRAMWAYS.—Walsall Tramways Committee have decided that the motor car purchased some time ago for adaptation as a motor parcel van be kept for use as a service car for the tramways, and that a second-hand English-made chassis be purchased and fitted up as a parcel van at a cost not exceeding £300.

TRAFFIC AT TRAMCAR STOPPING PLACES.—The Watch Committee at Bath have been considering the question of following the example of Glasgow in the matter of a by-law prohibiting motor cars and other vehicles from passing stationary tramcars on the near side. For the present the committee have decided to erect danger signals where necessary.

TEST OF MOTOR AND HORSE HAULAGE.—The street cleansing department of the Bradford Corporation have decided to make a test of motor against horse traction in the delivery of coke, each method being used for a week. This decision has followed on receipt of a report that over 1,000 yards of street are swept by a motor sweeper in twenty minutes at a cost of 1s. 10d., as against 75 by team labour at a cost of 1s. 10½d.

DENNIS "A" TYPE LORRY IN SYDNEY.—The Dennis lorry illustrated below was supplied to Messrs. A. Forsyth and Company, Limited, Waterloo, Sydney, N.S.W. It was sold through Messrs. Davies and Fehon, of Sdyney, the agents of Messrs. Dennis Brothers,

Limited, of Guildford. The chassis is the standard type War Office subvention model, and reports received by the makers show that the vehicle is giving complete satisfaction to its owners.

ELECTRIC VEHICLES AT GRIMSBY.—As there are now four battery vehicles in service in the town, the Public Lighting Committee of Grimsby Corporation have adopted a suggestion, made by Mr. A. S. Channon, the deputy electrical engineer, that a corrugated iron lean-to shed be erected at the power stand as a shelter to the vehicles while being charged at the power-station.

A.S.C. DELIVER COAL.—During the recent frosty weather there was a falling off in the coal deliveries in the poorer parts of London. At the instance of Lieut.-General Sir Francis Lloyd, commanding the London District, fifty A.S.C. motor wagons, their drivers, and

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MOTOR TRAFFIC.

a number of other soldiers were placed at the disposal of the Lord Mayor and the London mayors to help in the delivery of coal.

Bristol Tramways Company and Gloucester.—An application was recently made to the Gloucester Corporation by the Bristol Tramways and Carriage Company for licences for several motor cabs, with the privilege of using the hackney carriage stands. The Council determined not to grant further licences until after the war on the ground that the drivers could be more usefully employed.

London Registrations.—The London County Council, during the quarter ended December 31 last, registered 304 heavy motor cars under the provisions of the Motor Car Acts, 1896 and 1903, making a total of 9,765 such vehicles. Other motor cars registered numbered 1,635, bringing the aggregate to 101,042. During the quarter 11,682 licences to drive were issued, the aggregate number now being 508,957.

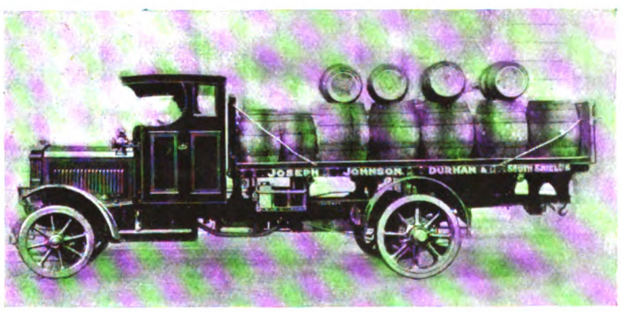
Motor Services for Film Transport.—Owing to the curtailment of railway facilities, a regular road motor service was instituted a few weeks ago between Liverpool and Manchester for the carriage of films to the picture theatres. The service runs every Sunday and Thursday, and the charges are said to be remarkably reasonable. Preparations are being made for the institution of a similar service within a radius of sixty miles of Glasgow.

Traffic Facilities and Town Planning at Birmingham.—In connection with the work of the Town Planning Committee of the Birmingham Corporation this year consideration will be given to the future improvement of the arterial roads and other main thoroughfares of the inner area of the city, and a possible remodelling of these with a view to their ultimate reconstruction, together with the consideration of all kinds of traffic facilities.

Omnibus Fares in Berlin.—Owing to the impressment of motor omnibuses by the military in Berlin, and to the shortage of petrol and tires, the General Omnibus Company's services at the end of 1916 had been reduced to one motor omnibus line and sixteen horse lines with 230 vehicles. At the beginning of the present year the fares were increased from one penny to 1½d. per stage, following an increase in September last from three farthings to a penny.

Women Drivers of Motor Vans.—The first entry from a woman driver in connection with the drivers' annual examinations, conducted by the Commercial Motor Users' Association, with the object of encouraging drivers to take a personal interest in their vehicles, has been received from a lady in the employ of a London house. Full particulars and entry forms may be obtained from Mr. F. G. Bristow, secretary, Commercial Motor Users' Association, 83, Pall Mall, London, S.W.

Praise for "Karriers."—The lorry illustrated below is one of several Karriers owned by Messrs. Joseph Johnson, City Brewery, Durham, and the Westoe Brewery, South Shields. The owners state that the vehicle has done over 9,000 miles, and renewals and



A Karrier Lorry.

repairs have cost only £4 1s. 4d. Mr. H. M. McLean, general manager of Messrs. Johnson's, says, "I cannot speak too highly of the way the vehicle has stood up to our work, which is very heavy." The lorry thus commended is a 4½-ton W.D. type Karrier.

City of London Motor Volunteer Corps.—Owners of commercial motor lorries who are willing to enrol, with their vehicles and drivers, in this corps, which is being formed under Army Council Instruction No. 90, of 1917, are invited to communicate with Mr. E. G. Bristow, 83, Pall Mall, S.W., and private car owners and motor cyclists are invited to communicate with Mr. E. D. Lowy, 12, Angel Court, Throgmorton Street, E.C. The nucleus of the corps comprises the mechanical transport section hitherto attached to the City of London National Guard.

Domestic Servants Conducting Omnibuses.—After witnessing the training of the girls employed as conductors by the London General Omnibus Company, it is not surprising to learn from Mr. H. E. Blain that nearly half of the 2,500 conductors were formerly domestic servants. Others were previously engaged in shops and offices. While the work has great attractions under the conditions arranged by the company for the welfare of the women employees vacancies are fairly numerous. Nearly 150 new conductors make their debut from week to week.

A Halley Lorry Ready for a Run on National Service.

L.G.O.C. and Motor Fuel Economy.—Without the public experiencing any noticeable inconvenience as regards motor-bus facilities, a very considerable saving of petrol is being effected by the London General Omnibus Company. There is a partial curtailment of omnibuses in the early hours of the morning, again just before and after midday, and again after 8.30 p.m. at night. At these times traffic is at its lightest. The time of first and last omnibuses remains unaltered, and only one route, No. 44 (Kilburn and London Bridge), has been withdrawn.

The Shrewsbury and Challiner Tyre Company, Limited, Ardwick Green, Manchester, are the successful tenderers for the supply of tires for the Manchester Corporation's motor omnibuses, motor tower wagons, and horse wagons for the twelve months ending March 31, 1918.

White Motors and Accessories, Limited, of Concanon Works, Concanon Road, Brixton, S.W., have recently received orders for jacks from the following:—Aberdare Urban District Council Tramways; Bristol Tramways and Carriage Company, Limited; Coventry Corporation Tramways; Newport, Mon., electricity and tramways department; and the Sheffield Corporation Tramways and Motor Department.

Petrol Electric Omnibuses for Wolverhampton.—Tilling Stevens, Limited, 26, Victoria Street, S.W., have a contract from Wolverhampton Corporation to supply two petrol electric omnibus chassis, together with two suitable bodies, at £1,016 each, subject to the sanction of the Director-General of Munitions Transport. At the meeting of the Council at which the contract was awarded, the hope was expressed that the Tramways Committee would secure double-deck bodies. The Corporation also agreed to purchase a 25-h.p. Albion omnibus from C. L. Wells, Limited, of Kingswinford. With this purchase the department will have six vehicles with which to reopen the services interfered with by impressments and to relieve pressure on existing routes.

Ferodo Friction Surfaces.—Owing to the continually increasing cost of raw materials, the manufacturers of Ferodo fabrics have been compelled to advance the prices of these fabrics 15 per cent., so that list prices are now plus 25 per cent. instead of plus 10 per cent. as hitherto. This increase came into operation on January 1 last, and it is only due to the fact that the makers held large stocks of raw materials, of which they determined to give their customers the advantage, that prices have been maintained at their previous level for so long a period. The well-known quality of Ferodo fabrics is fully maintained. Should any difficulty be experienced in obtaining supplies, a post-card should be addressed to the makers, the Herbert Frood Company, Limited, Chapel-en-le-Frith, Derbyshire.

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THE Tramway & Railway World
WITH MOTOR TRAFFIC SECTION

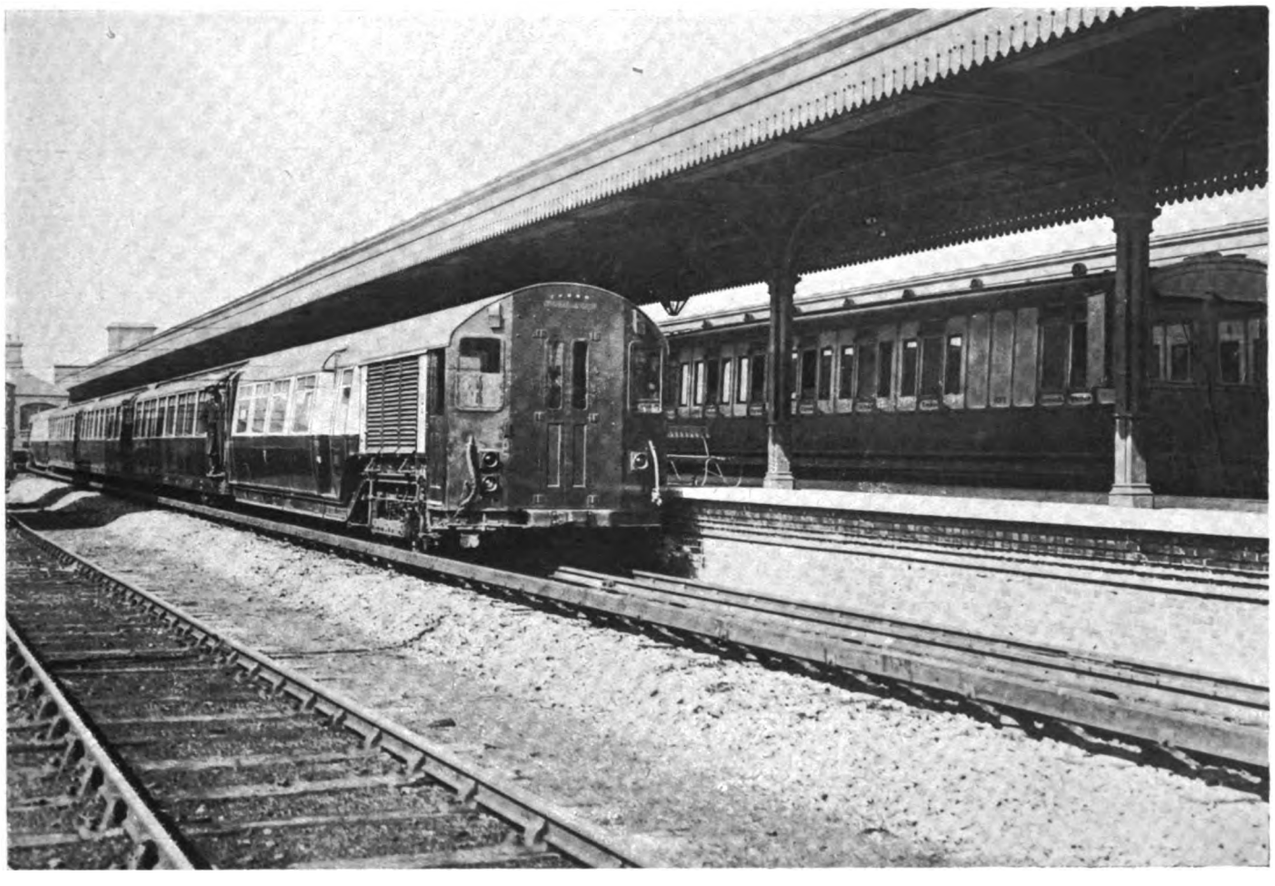
Founded 1892. LONDON, APRIL 12, 1917. VOL. XLI.

BAKER STREET & WATERLOO AND LONDON & NORTH WESTERN RAILWAYS.

THE WATFORD EXTENSION.

The new link of the Baker Street and Waterloo and the London and North Western Railways from Willesden Junction to Watford will be opened to the public on Monday, April 16. This makes the sixth extension of the Bakerloo line since its inception in March, 1906, the previous extensions being between Westminster Bridge Road and Elephant and Castle in 1906, Baker Street and Great Central 1907, Great Central and Edgware Road 1907, Edgware Road and Paddington 1914, and Queens Park and Willesden 1915.

This new extension of the underground system forms an important part of the London and North Western Company's scheme of suburban electrification, which was described and illustrated in our issue of November 9, 1916. It will open up a large area of new countryside and residential districts, and will directly connect the north-western suburbs with the central, west end, and south-eastern districts of London. In addition it will give passengers using the London and North Western Railway system a choice of something like five terminal stations connecting with main line railways, the new line coupling up Paddington (Great Western), Marylebone (Great Central), Charing Cross (South Eastern and Chatham), and Waterloo (London and South Western) with Willesden Junction and Watford. It will also mean for the business man a direct linking up of the west end and central London areas, with facilities for reaching all parts of the metropolis.



Watford-Bakerloo Train at Watford Station—Opposite is seen a London and North Western Train.

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After coming to the surface at Queens Park, the Bakerloo trains will run over the electric lines of the London and North Western Railway system to Watford, *via* Willesden Junction New Station. The extension has increased the length of the Bakerloo route to 20 miles 66 chains, and added another 12 stations, the complete list of stations from end to end being as follows :—

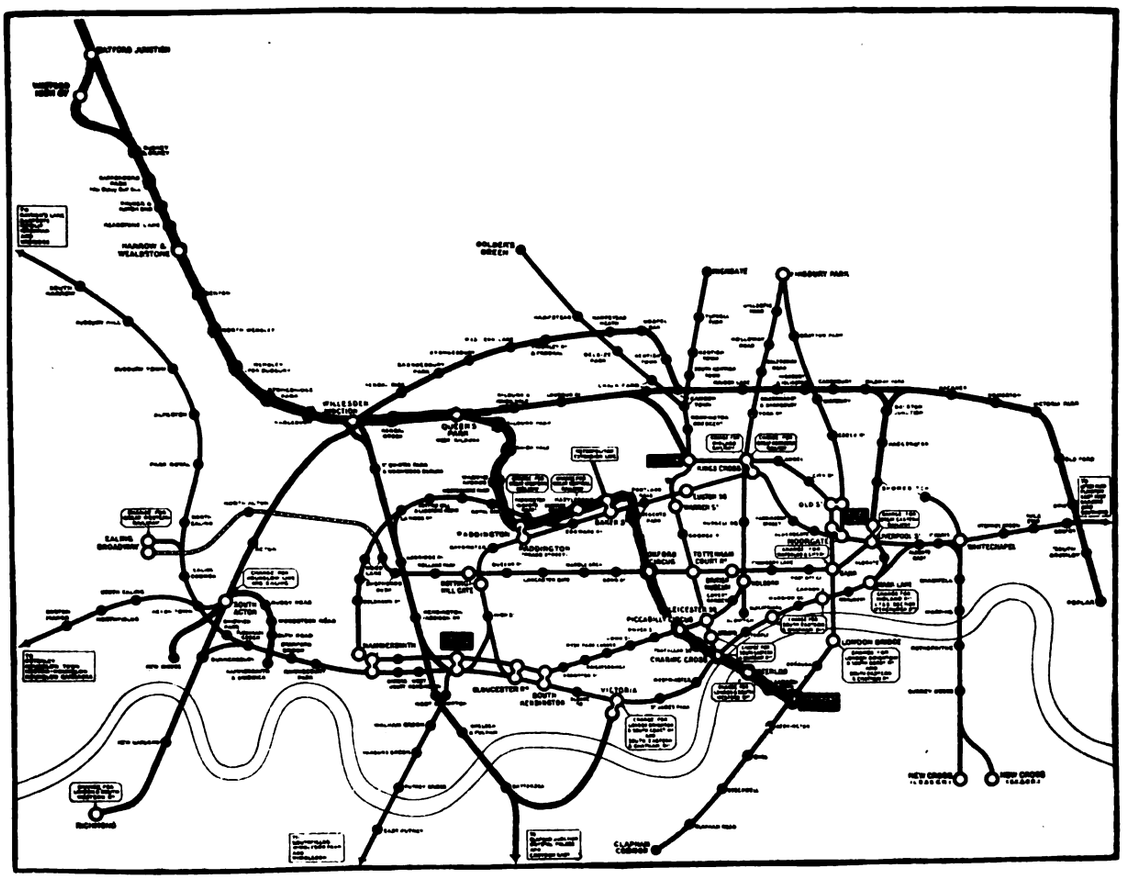
Watford	Stonebridge Park*	Marylebone
Watford High Street	Harlesden	Baker Street
Bushey and Oxhey	Willesden	Regents Park
Carpenders Park*	Kensal Green	Oxford Circus
Pinner and Hatch End	Queens Park	Piccadilly Circus
Headstone Lane	Kilburn Park	Trafalgar Square
Harrow	Maida Vale	Charing Cross
Kenton	Warwick Avenue	Waterloo
North Wembley	Paddington	Lambeth North
Wembley	Edgware Road	Elephant and Castle

* Temporarily closed.

The journey throughout will take about one hour, and there will be a quarter-hourly service throughout the day to Watford, the total number of trains in each direction being 72. The first and last trains from Elephant and Castle and Watford will be :—

From Elephant and Castle ... 5.16 a.m. (first) ... 12.52 a.m. (last)
From Watford ... ... 5. 0 a.m. ,, ... 10.45 p.m. ,,

With the inauguration of this new service a number of steam trains running between Euston, Willesden, and Watford will be taken off during the slack periods of the day, and in their place new steam services will be run between Euston and Willesden New Station affording direct connection with the Bakerloo trains between this latter point and Watford. Similar connections will also be given in one or two cases by existing steam trains running between Euston and Willesden main line station (adjoining the new station). The London and North Western Railway steam trains which now travel between Watford and Euston and Watford and Broad Street over both the main and new lines will continue to run during the morning and evening rush hours.



Map Showing Route of Through Service, Watford to the Elephant and Castle.

Through ordinary tickets and three-monthly and monthly season tickets will be issued to all the above stations, and through ordinary tickets will be issued to certain stations on the Piccadilly, Hampstead, Central London, and City and South London Railways.

At Watford connection can be made with the London and North Western Railway branch services to Rickmansworth, St. Albans, Croxley Green, and outer suburban stations on the London and North Western Railway to Berkhampstead. A motor-omnibus is also run from Watford to Kilburn Park Station, and feeds the railway at Bushey and Watford.

For the present Bakerloo trains will not call at Carpenders Park and Stonebridge Park on the London and North Western Railway, and they will pass without calling at Maida Vale and Regents Park, while at the rush hours trains will pass other Bakerloo stations with a view to giving a quicker run and relieving them of a certain amount of local traffic. The upper half of the cars on the Watford trains will be painted white in order to distinguish them from the local services, and will run only on weekdays, the Sunday services on the Bakerloo running, as now, only as far as Willesden.

Power and Rolling Stock.

Electric current at 600 volts D.C. will be supplied north of Queens Park to Bakerloo trains from the

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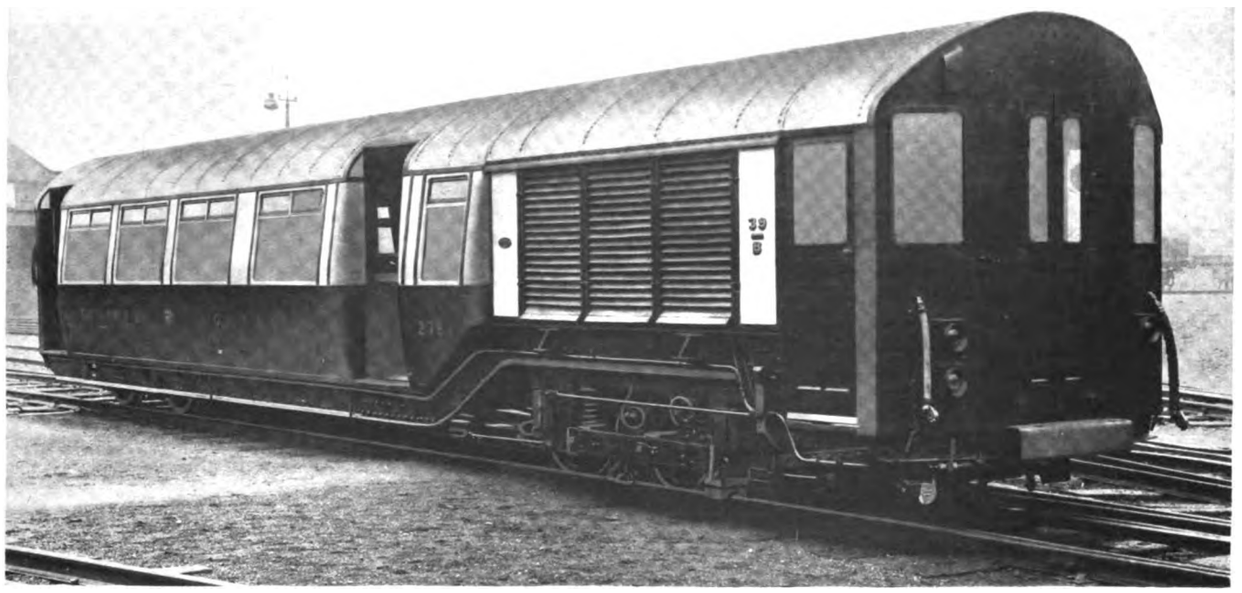

Exterior of Motor Car.

Interior of Motor Car.

Views of Central London Railway Motor Car Fitted for Running on Watford Extension.

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London and North Western Railway power house at Stonebridge Park. The trains consist of five cars each, two motor cars and three trailers. The trailers are standard London Electric Railway stock, while the motor cars were designed for the Ealing extension of the Central London Railway to work over the new Great Western line from Wood Lane to Ealing Broadway.

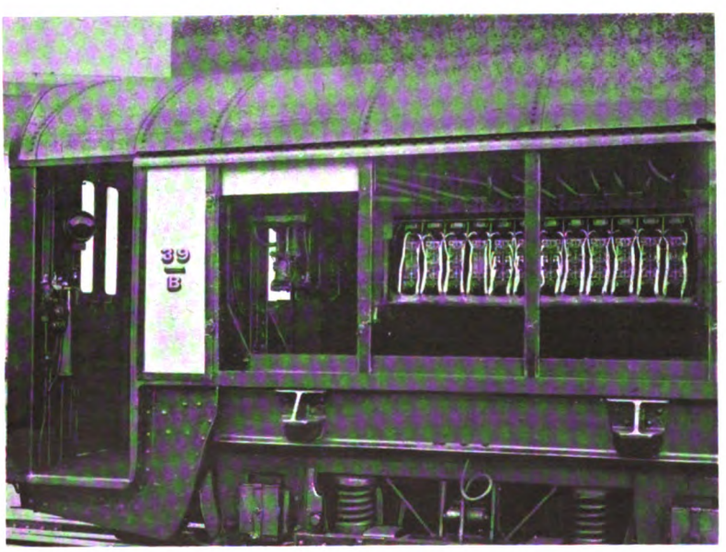
As the Central London system employs an earth return, while the London Electric Railway system employs an insulated return, it has been necessary to modify the equipment of the motor cars. For this purpose two additional sets of shoe gear have been fitted on the motor trucks, one on either side. On the trailer truck of the motor car there was insufficient clearance below the sole bar of the body to fit positive shoes, so that these have had to be arranged on the truck of the adjacent London Electric Railway trailer car, and connection made to the motor car by means of jumpers.

Other points in the conversion from earth to insulated return were the provision of negative switches and fuses to the main circuit and each of the auxiliary circuits. In doing this care was taken to reproduce the standard arrangement of London Electric Railway wiring, so that electrically the difference between the two types of stock should be confined to the control equipment.

The control equipment supplied by the British Thomson-Houston Company is of the relay automatic type. The normal method of operation with this system is to place the controller at once to the full "on" position when starting a train. The contactors are then picked up in their correct sequence by the current limit relay, which operates as soon as the motor current has dropped to a pre-determined value.

The relay consists of two shunt coils and one main coil. The latter carries current equal to that of one motor only. The actuating coils of the contactors are energised through one or other of the two shunt coils in such a manner that, if one is energised through one shunt coil, the next one to close will be energised in series with the other shunt coil. The two relay shunt coils act on two plungers controlled by gravity. Each plunger when in its lower position closes a disc switch in series with the other shunt coil, but when raised (due to its coil being energised) it opens this switch. Thus, when one of the plungers is raised, the shunt coil acting on the other cannot be energised because of the break in the circuit produced by the above-mentioned switch, but although it is the control current that raises the plunger, so as to produce this break, it is the current passing through the main coil which maintains the break, and the plunger is not released until this current has dropped to the pre-determined value. Then the plunger falls and closes the switch, which completes the circuit for the next contactor coil to be energised.

Interior of Motor Cab, showing Main Switch and Front of Contactors.



Cab of Motor Car showing Backs of Contactors and Interlocks.

The principle underlying the method of control adopted in connection with the current limit relay is that after a contactor has been picked up as described above, its coil is immediately transferred (by means of interlocks) to another wire. There are thus essentially two operating wires, the picking up wire and the retaining wire, although other wires are introduced for forward and reverse, circuit breaker setting, etc.

As there are no main bus lines down the train, a potential relay is fitted on each motor car, which drops all contactors on that car when the shoes lose current. This is necessary because when no current passes through the main coil of the current limit relay it ceases to exercise its control over the rate of picking up contactors.

The controller has four forward points and two reverse (series only), of which numbers 2 and 4 are running points, where all resistance is cut out. A useful provision in the control is that if in the course of the automatic notching up the controller handle is brought back to the first or third notch, as the case may be, the automatic closing of contactors is stopped, but those already closed are kept up.

The working of the safety button on the controller handle differs from the London Electric Railway standard in that the safety button can be released,

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except when the handle is at "off" position. If, however, the handle itself be let go, it flies back to "off" position, when current is instantly cut off and the brakes applied throughout the train. Another safety device, which is now part of the standard London Electric Railway equipment, is the control circuit governor. By interrupting the control circuits it prevents the train being driven forwards, unless the train pipe of the Westinghouse brake is charged with air and the tripcock is cut in.

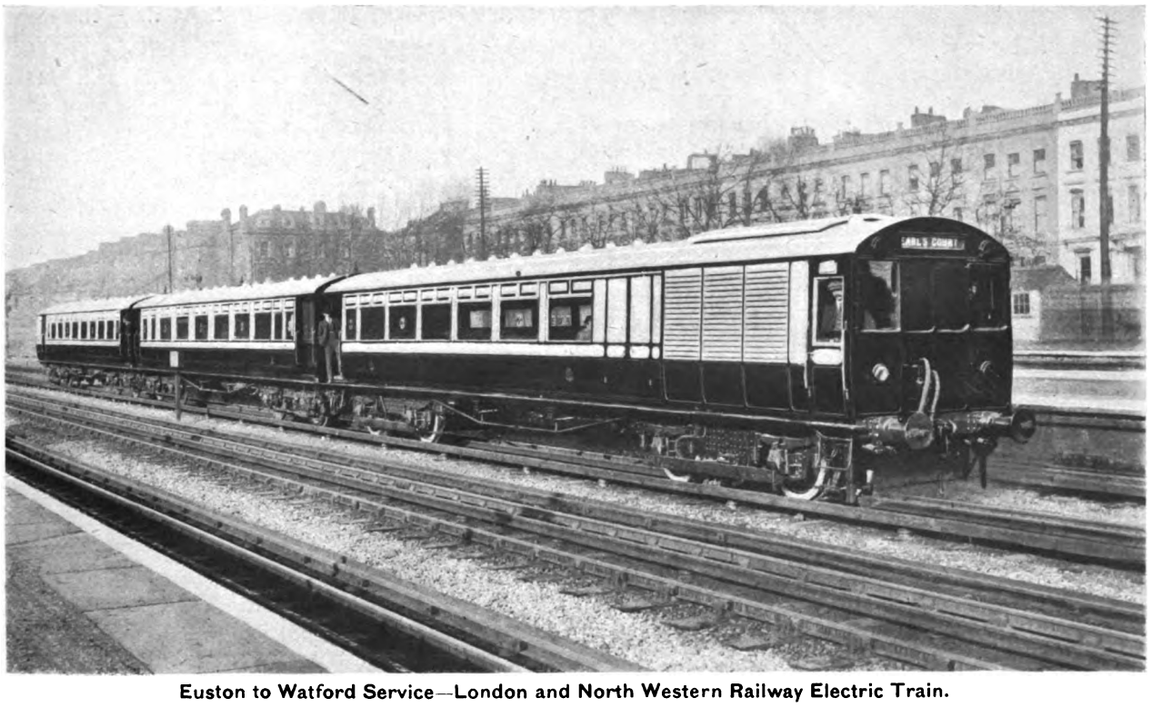
Each motor car is fitted with two G.E. 212 motors of 240 H.P., geared for a free running speed of 35-40 miles per hour. The brake equipment is Westinghouse, with improved triple valves on the motor cars and quick-acting triple valves on the trailers. The brake blocks are of unchilled cast-iron. The air compressor is of the British Thomson-Houston C.P. 28a type.

All cars are fitted with emergency lights supplied with current from accumulators carried on the motor car, and arranged to switch on automatically in the event of the main supply of current failing.

5-Car Watford-Bakerloo Train near Watford High Street Station.

It will be seen that the motor cars are provided with a covered vestibule at the trailing end, and that middle doors have been fitted. The control of the latter is similar to that described in connection with new stock for the Queens Park extension in our issue of March 12, 1914.

This is the first tube railway stock to be run in passenger service on a main line, and provision has had to be made to enable passengers to get on or off at the stations on the London and North Western line which have platforms of the standard main line height. This has been done on the trailer cars by superimposing a raised platform on the existing gangways of



Euston to Watford Service—London and North Western Railway Electric Train.

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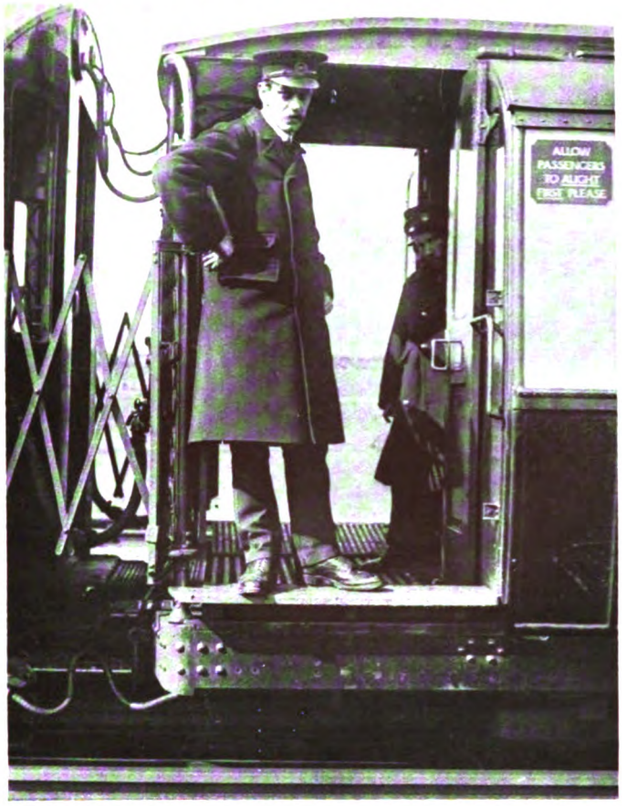
these cars. It has been possible to do this without encroaching on available headroom owing to the open character of these gangways. The closed vestibule has prevented any similar provision being made on the motor cars.

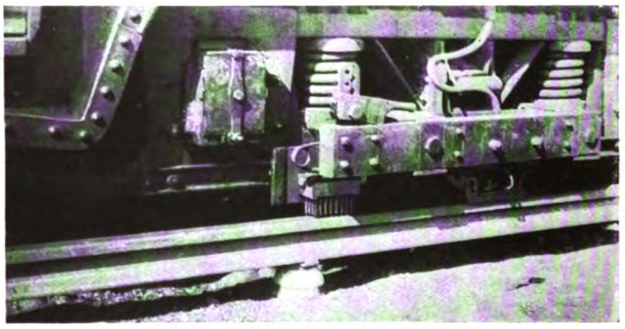


View of Ramp Equalising Platform Levels.

The floors of the motor cars are of fireproof material by the Sanit Flooring Company. The number of seats in the motor cars is 32 and in the trailer cars 52. The seats of the motor cars are upholstered in red pegamoid supplied by G. D. Peters and Company. The seats in the trailer cars are being upholstered in moquette, but some of the cars will enter service at the start with the original rattan seats.

The interior steel panels of the motor cars are painted light brown to tone with the colour of the mouldings, etc., which are of teak or steel painted to match. The lamp fittings and ends of cross seats are finished in oxidised bronze; other fittings are of aluminium alloy. The ceiling of the arch roof is of agasote enamelled flat white. The exterior colour of the cars is lake, with white upper panels and gold lettering. With regard to ventilation, in addition to the ordinary drop lights an air duct with perforations runs the whole length of the car, and is open to the air at the ends.

The cars are constructed of steel, with some wood interior finish. The motor trucks are of the equaliser bar type with helical bolster springs. The framing is built up of mild steel rolled sections. The trailer trucks are built up of pressed steel sections, and



Sleet Brush in Working Position.

are fitted with the ordinary laminated side bearing springs. The cars were constructed by the Brush Company at Loughborough. The leading dimensions and weights are as follows:—

Length over all	47 ft. 9 in.
Width over body	8 ft. 9 in.
Total height from rail	9 ft. 3½ in.
Centres of bogies	29 ft. 6 in.
Diameter of motor wheels	36 in.
Wheel base of motor bogie	6 ft. 8 in.
Diameter of trailing wheels	29 in.
Wheel base of trailer bogie	5 ft.
Weight of car completely equipped:—	
Motor end	21½ tons
Trailer end	9⅛ tons
Total	30¼ tons
Total weight of 5-car train unloaded	110 tons

Watford-Bakerloo Extension—New Electric Lines on Right.

Harrow Station—Watford Extension.

Petrograd Tramways Popularity.—During the Russian revolution the Petrograd tramways service was stopped for several days, and before traffic could be resumed an accumulation of snow had to be removed.

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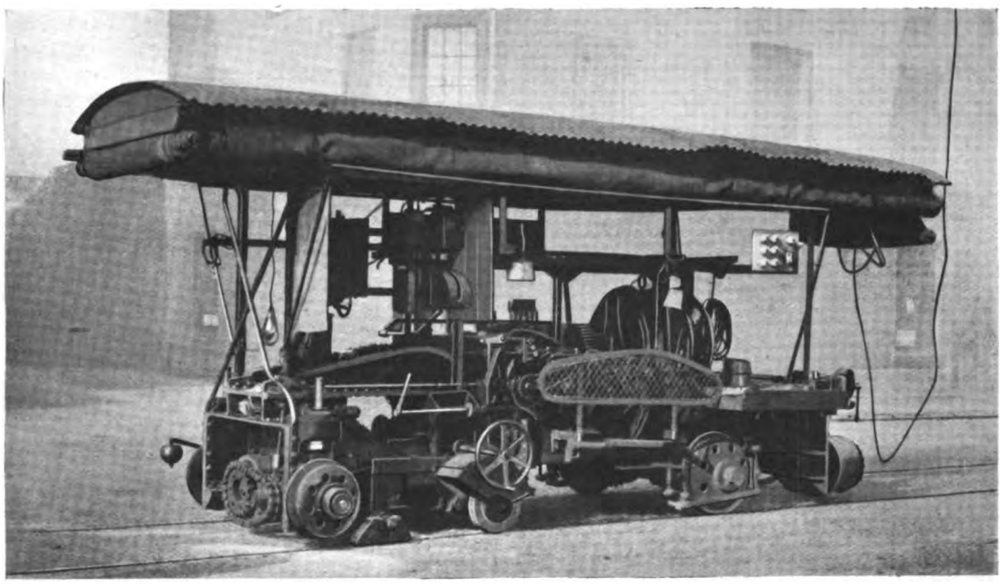
REMODELLING RAILS AT CARDIFF.

THE WOODS-GILBERT RAIL PLANER AND GRINDER.

Illustrations were given in our issue of October 12 and November 9, 1916, of the rail tread grinding machine of the Woods-Gilbert (British) Rail Grinding and Milling Company, Limited, and also of lengths of rails on the Bexley Urban Council Tramways before and after treatment by the machine. The operation was undertaken in order to free the rails of corrugations and dishing at joints, and to deepen the groove of worn rails. It was seen in progress by many of the delegates who attended the 1916 conference of the Municipal Tramways Association.



Rail Planing Machine at Work on the Track.

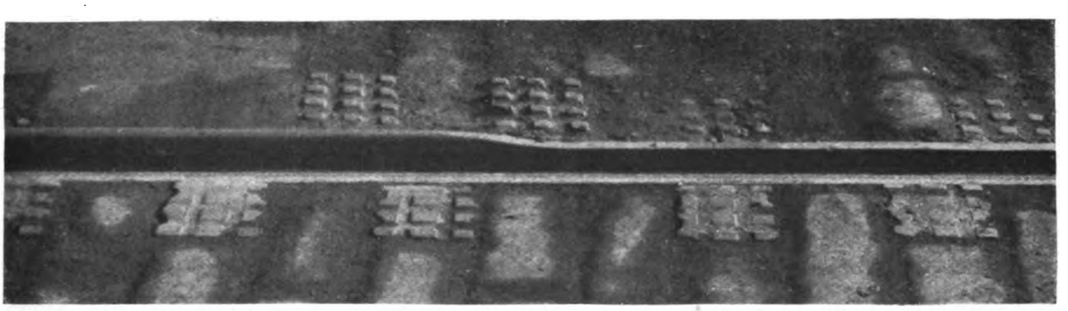
In the meantime similar work has been in progress at Cardiff, where the company have used the machine illustrated above. The Cardiff Corporation Tramways Committee having reports of the results obtained at Ashton and elsewhere by the Woods-Gilbert system, decided a few months ago to employ the company to remodel completely the rails on five miles of track which were badly worn. The contract is now nearing completion, and the company are expecting within the next month to remove the planing machine (illustrated on this page) to Bolton for use in conjunction with the Woods-Gilbert latest type of grinding machine which is already in operation on the tramways in that town.

The type of rails in use on the Cardiff tramways is British Standard 100 G 6¼ in., and the rails were laid in the year 1902. When new these rails had a depth of metal under the groove of $\frac{21}{32}$ in., and from this the planing machine removed $\frac{9}{32}$ in. of metal, leaving $\frac{3}{8}$ in. under the groove after remodelling. The guard lip on the rails was $\frac{5}{8}$ in. thick, and the height of this has been reduced by the machine $\frac{3}{8}$ in. to bring it to the level of the tread of the rail.

The whole of the section has also been treated for corrugations and joints, many of the latter being in a badly hammered condition. This has resulted in much smoother running of the tramcars, therefore benefiting the rolling stock and the track.

In the period that had elapsed from the time of relaying the track to the time of the commencement of remodelling, an average of about $\frac{14}{32}$ in. had been worn off the head of the rail. This occurred in a period of about 12 years. As the groove has now been deepened $\frac{9}{32}$ in., it is expected to result in at least seven years' additional life being added to the track.

The cost of the work has been less than one-twentieth of the estimated expense of reconstruction at pre-war prices. This and other aspects of the contract are thus stated in a letter from Mr. W. Harper, the city engineer of Cardiff :—



Portion of Rail Showing (Left) Lip Before Cutting and (Right) After Cutting.

The length of track treated by the machine is five miles of single track. The depth of metal removed from groove is ¼ in. and from guard lip ⅜ in.

It is too early to form an accurate opinion of the additional life given to the rails by the foregoing treatment, but I think we may fairly assume five years.

The cost of relaying the track, reduced to single line, would have been (*a*) at present prices £15,600 per mile, (*b*) at pre-war prices £7,800 per mile.

The improvements effected are increased life of rails, safety of other traffic due to removal of dangerous projection of guard lip, benefit to rolling stock and foundation of track on account of smooth running after removal of corrugations.

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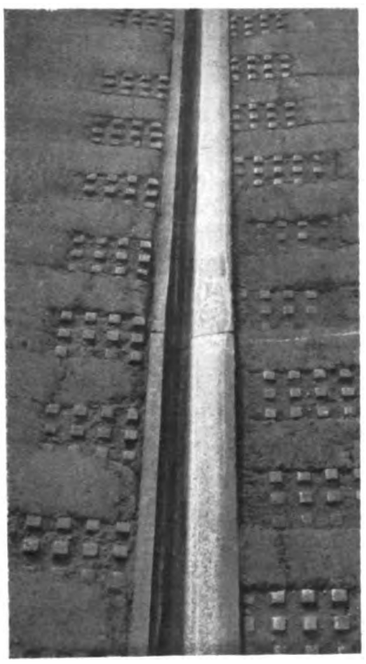
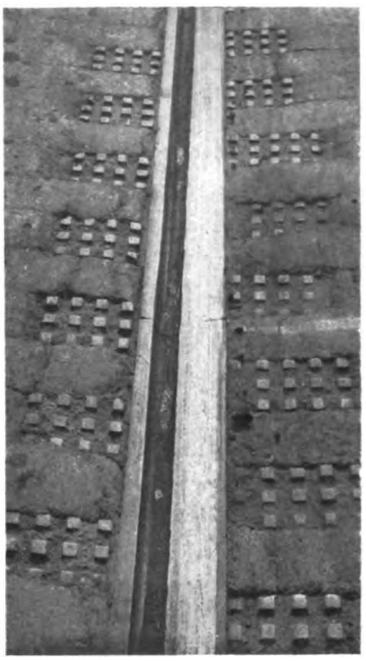
That the planer and grinder effectively perform the operation of remodelling will be apparent by an inspection of the accompanying illustrations. The photograph of the lips of a rail before it has been cut down reveals the rail in a condition which, to say the least, is destructive to the cars and is also dangerous. The right-hand side of the same photograph shows what a transformation the planer is able to effect. Equally effectual is the operation of remedying dished joints. Separate illustrations are given to show a joint before and after dressing.

The services of the company have been utilised with satisfactory results upon worn-out rails of several tramways in this country, and at Wigan a second contract has been entered into. On the four miles of track already treated in that town the wheel flanges were in contact with the bottom of the groove, which has been deepened to three-quarters of an inch by the use of the planer, at a cost not exceeding £530 per mile. Other tramway undertakings upon which remodelling has been successfully accomplished are Oldham, Ashton, and Hyde and the Isle of Thanet. The invention was introduced in this country after it had been used to carry out extensive contracts in Melbourne, Sydney, Brisbane, and Adelaide. At this period of the war, when tramway rails are unobtainable, there can be no question of the great importance of the company's work. One marked advantage of the machine especially valuable is that it can be used at night without causing obstruction to the traffic. When not engaged in milling or grinding it can be run along the rails at speeds up to 20 miles an hour. Thus it can be rapidly run to a crossover to allow a car to pass, or by the use of transverse gearing the machine can be quickly removed from the rails. When grinding it treats approximately 12,000 ft. of single track per month, or 9,000 ft. of single track when milling. For a full description of the construction and working of the planer and grinder reference may be made to the TRAMWAY AND RAILWAY WORLD of November 9, 1916.



Joint Before Dressing.



Joint After Dressing.

The Municipal Council of Stavanger propose to expend the sum of 1,275,000 kroner in the construction of an electric tramway in that city.

TRAINING OF WOMEN DRIVERS.

THE SYSTEM ADOPTED BY THE GLASGOW CORPORATION TRAMWAYS.

There are now nearly 300 women, formerly conductors, engaged in driving cars on the Glasgow Corporation Tramways, and the general manager has appealed to every suitable woman conductor to undergo the training in order to release motormen. In the training of women as drivers exactly the same course is followed as with men, the arrangements being in the hands of the traffic superintendent, while the instruction is given by an experienced engineer at the school at the Coplawhill Car Works. The following is a description of the school and the course of tuition, for which we are indebted to the general manager, Mr. James Dalrymple :—

After a period of satisfactory service as conductor —from six to twelve months—each man is withdrawn from the cars and put under training as a motorman. The period of training extends over 12 days, during which full wages are paid. A single truck car of the standard type is erected over an inspection pit and supported on blocks so that the motors and gearing may be seen in operation. The car body is simply a skeleton which is mounted on a truck. All motor cables and lighting wires are painted in distinctive colours. This enables learners more readily to understand the general scheme of connections and location of various switches, fuses, &c. The braking gear and sand apparatus can easily be inspected. The car has a movable floor, so that the motors may be laid open for examination. On the platform a series parallel controller is erected with the usual operating gear, and glow lamps are connected across the motor terminals so that the action of the controller may be more easily understood. The trolley is connected to a "live" wire supplying the current for motors and lights. The school is also equipped with samples of each trolley pole and standard used on the cars.

On a long platform at the side of the school, opposite the car, ten controllers and brake handles are erected in the same position as they are fitted on the cars, and samples of all types of controllers in use on the system are fitted up for examination and inspection. The brake spindles on the platform are each connected to a strong spring, so that their action is practically the same as the actual car brakes. Large diagrams showing controller connections are used to explain the action and proper working of the controllers and electric brakes, and men are also instructed in the use of a telephone similar to those erected at various points on the system.

The class in the school generally consists of 12 to 15 men. From 2 to 3 per cent. fail to pass the necessary examination. Each man is supplied with instruction book on entering the service, and during his first three days' tuition he attends the school. On the first day the instructor carefully explains the use and action of the various appliances fitted on the car, and shows how the mechanism should be operated. Learners are also drilled by means of the fixed controllers and brake spindles already referred to, and the correct manipulation of the handles is explained, particular attention

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being paid to correct methods of acceleration and braking of cars for service and emergency stops.

The forenoon of the second day is taken up with an explanation of the "Rules for Motormen" section of the "Rules and Regulations for Officers and Servants of the Glasgow Corporation Tramways (Traffic Department)." The pupils are shown how faults may occur in car, track, and overhead equipment, and what should be done in such cases. A portion of this day is devoted to further practice of the braking methods and correct manipulation of the controllers. In the afternoon the faults referred to in the forenoon are effected on the school car, and each learner is assisted to locate and remedy the defects. Practical demonstration is made of how live wires should be handled, and of how they may be rendered "dead" when necessary.

On the third day the forenoon is taken up with a careful *resumé* of the instruction already given, and a preliminary examination is conducted to ascertain how each man is progressing. In the afternoon the class is taken out to Coplaw Street, where there is a side line of considerable length with a fair gradient. Here the men are tested on a special school car, fitted with magnetic brakes and all the most recent equipment supplied to cars in regular service. Each man is carefully coached in operating the car, both backward and forward, and in making emergency and service stops when running at various speeds in either direction. Every possible care is taken to instruct the men carefully and thoroughly in all points relating to the practical and correct operation of cars. Twenty or thirty minutes is allowed each school day for men to examine, in their own way, the several types of controllers and other apparatus in the school, and the instructor is at hand to give any explanation or instruction that may be necessary.

For the next four days—that is, on the fourth, fifth, sixth, and seventh days—the learner is out on the road under the care of an experienced motorman, who has, after examination, been authorised to instruct learners. He here learns to handle the car through traffic. The learners are frequently visited on the road by the Motor Inspectors, who make notes of the progress shown, and report to the Chief Instructor. On the eighth day the learner goes back to school for a preliminary examination in his knowledge of car details and platform duties. The afternoon is spent on the school car in Coplaw Street, testing each applicant's general expertness, ability to apply the various braking methods, and to make emergency stops with the electric brakes when running at different speeds. Men who are unsuitable are now rejected and sent to head office to be dealt with.

The next three and a half days are again spent on the road in regular service under an experienced motorman, and special attention is given to men who have shown signs of nervousness or carelessness. The afternoon of the twelfth day is taken up with a final examination, conducted by the Chief Instructor at the motor school, when satisfactory men are passed, and their certificates forwarded to the head office.

A system has been instituted in Glasgow of examining each motorman or motorman-conductor once every six months or thereby, and men who fail to answer questions satisfactorily at this examination are withdrawn from service, and sent back to school for one or two days at their own expense. If they still fail to answer questions satisfactorily, they are dismissed from the service.

A periodical examination every three or four months has also been instituted for conductors. This examination embraces all the rules laid down as to the duties of conductor.

HALFPENNY FARES IN EAST LONDON.

The report of the Highways Committee of the London County Council on the subject of the proposed abolition of halfpenny fares on the through running routes in the eastern districts of the Metropolis will probably be presented at a meeting of the Council in May. The question was referred to the committee on August 1 last on the receipt of communications from the West Ham and East Ham Corporations and Leyton Urban Council, who proposed to abolish halfpenny fares on their portions of the through route. In dealing with the letters the committee recommended that they should be "authorised to enter into negotiation with the three Councils with respect to through running agreements." Mr. G. H. Hume, chairman of the committee, remarked that personally he would hesitate to ask the Council to abolish halfpenny fares, as the proportion of revenue obtained from them was too great. The discussion then turned upon the question of the attitude of East End residents if halfpenny fares were taken from them and allowed to remain in other parts of London. There was also speculation as to what would be the attitude of the omnibus companies, who only concede halfpenny fares on routes where their vehicles compete with tramways. Finally the following motion by Mr. J. W. Gilbert was carried by 53 votes to 30:—

> That the Council, whilst prepared at all times to confer with other tramway authorities in connection with through running arrangements on questions of fares and fare stages, is of opinion that no sufficient cause has yet been shown for depriving the inhabitants of the county of those facilities for cheap transit that are conferred by the existence of halfpenny fares, and accordingly instructs the Highways Committee to report, after conference with the Leyton Urban Council, and with West Ham and East Ham Corporations as to the desirableness or otherwise of abolishing or suspending halfpenny or other particular fares or of varying fare stages on the through routes with which those authorities are concerned.

The delay in the presentation of the Highway Committee's report appears to have been caused by the varying decisions arrived at on the question by West Ham and Leyton Councils, but ultimately the three outlying authorities reached unanimity, and halfpenny tickets ceased to be issued on their tramways during the past month of March. One of the strongest opponents of the abolition has been Councillor O. Waters, chairman of Ilford Tramways Committee, who pointed out that if the halfpenny fare was abolished in the High Road and Ilford Lane the residential district of Cranbrook Road would be in the privileged position of enjoying halfpenny fares on the motor omnibuses. It was not necessary, he urged, from a financial point of view to make such drastic alterations as were recommended in raising the fares for other stages also. The manager estimated that even with the increased expenditure this year, they would be about £700 to the good at the end of the financial year in March. Referring to Walthamstow, which had discarded halfpenny fares, and in the last three months showed increased receipts, £1,359, or £153 a week, he pointed out that the increased revenue per car-mile was ·59d., but in Ilford over the same period the increase had been ·64d. Ilford Council ultimately withdrew the halfpenny stage for adults, but deferred the Tramways Committee recommendation to substitute higher charges generally.

The London General Omnibus Company continue tentatively to issue halfpenny tickets, but have reduced the distances up to and just over half a mile. The company are also using displayed advertisements in the daily newspapers to call attention to the new halfpenny stage points.

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THE
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A Shackled Industry.

The final report of the Dominions Royal Commission, to which reference is made in another column, contains recommendations for the development of Empire trade and industries that should lead to valuable results. Through various other agencies much attention is now being turned to the development of trade and industry in the oversea dominions. We should like now to see some corresponding attention paid to the fostering of our home industries. So far as manufacturing is concerned, it may be assumed that it will benefit from the policy of imperial preference, but beyond that little in the way of concrete proposals has been suggested. There are some important home industries which will derive no direct benefit from tariffs, while the indirect benefit that will accrue can only be gradually felt. A conspicuous example of such an industry is that in which readers of this journal are specially interested. There appears to be no immediate prospect of Government action to remove the fetters which have for so many years thwarted the natural progress of street and road tramways. That industry from its earliest days has been shackled by legislation. There was first the Tramways Act of 1870, the purchase clause of which retarded and finally almost killed private enterprise. Tramway business as the result of that Act inevitably came largely into the hands of municipalities. With very few exceptions, all towns of importance took over the tramways and introduced electric traction; but the great extensions that should have followed the introduction of modern methods did not take place. Local authorities did not feel warranted in going beyond their boundaries; they were unwilling to grant running powers over their lines to companies that might have been willing, had such consent been obtainable, to construct tramways in adjacent suburbs and rural districts. Thus what should have become a great and thriving industry throughout the country, bringing the immense advantages of convenient, rapid, and economical transport to multitudes of small towns and villages, and helping in a large measure to promote activity in agricultural districts, has remained in a condition of arrested development. While in many other countries in the years preceding the war the means of local transport were rapidly and extensively enlarged, leading to the quickening of domestic trade and the encouragement of many local industries, in this country the construction of new lines dwindled by degrees until in 1913 only about forty-five miles of electric tramways were built. At one time hope was entertained that the industry might escape stagnation by the help of the Light Railway Act, but these hopes were doomed to disappointment. The kind of track construction allowed under that Act was almost as expensive as for ordinary tramways. Other difficulties were raised, and the Act has now become practically useless. Thus it comes about that in the United Kingdom tramway and light railway enterprise has been well nigh extinguished. Up to 1906 progress had been fairly rapid. In 1907 there were 2,394 miles of route and about 11,800 cars. We have now only 2,750 miles of route and about 14,000 cars. This, it is true, is a considerable increase, but it was mainly accomplished before 1912. Since then little progress has been made, and in view of our population and its distribution the increase represents an entirely inadequate

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provision for the present needs of the people. Compare the position, for instance, in certain populated districts in America. A man standing on the roof of one of the great office buildings in New York has within his vision a range of territory in which there are more tramway cars than are in service in the whole of the United Kingdom, including the Metropolis. It is probable that a comparison with a few other centres in the United States would show a similar disproportion. There are various explanations for this, but the principal factor that has caused the difference is the encouragement given to enterprise. The people wanted transport facilities much more than they desired a precarious contribution to local taxation. No obstacle was placed in the way of those who were prepared to give them what they needed, and so electric progress went forward by leaps and bounds. Had enterprise been allowed an equally free field in this country it is a safe estimate that we would have had by this time 50,000 electric cars in service, with a corresponding increase in track mileage. In comparison with this our increase in the last ten years of 400 miles of route and 3,000 electric cars is a bagatelle. It is reiterated in innumerable speeches and daily in the columns of newspapers that after the war reforms of all kinds are to come in a flood. We hope that among them will be included a radical change in the laws governing tramway and light railway construction. If that hope is realised there is no doubt that arrears of construction would be rapidly overtaken and the country would be given a system of local transport such as would greatly assist in the development of industry which must take place if the financial burdens resulting from the war are not to press unduly upon the people.

Strike Settlement Procedure.

The ending of the Liverpool and Barrow munition workers' strikes and the prevention of an attempt to call out the public vehicle workers of the Metropolis are matters upon which the Labour Minister may be congratulated. When towards the close of the first Coalition Government a Labour Advisor's department was created, with Mr. Henderson as its chief, there was criticism on two grounds. Forgetting that the working people are called upon to exercise the preponderating influence on the war, a small class of critics objected to any concessions to Labour. A more farseeing contention was that a Labour Minister was necessary. Mr. Lloyd George took the statesmanlike view of the question when forming the present Government, and it must be admitted that the country has been well served by Mr. Hodge during the short period he has occupied the position of first Labour Minister. Much of the work accomplished does not come before the public, but it is otherwise in the matter of strikes of labour connected with munitions. A cursory study of the department's actions in that respect indicates that Mr. Hodge is a Minister to be reckoned with. At Barrow, as at Liverpool shortly after his appointment, he was prompt to interpose when the men took up an unreasonable attitude. Barrow provided a particularly flagrant instance of the strikers attempting to dominate the situation, but the Minister was firm in his determination to secure a resumption of work before entertaining any discussion. The strikers had violated both the Munitions of War Act and the Defence of the Realm Regulation, and it therefore became an easy matter to secure obedience. Notices were posted to the effect that they became liable to a penalty of £5 per day per man, while men who had incited them were liable to penal servitude for life or such less punishment as might be imposed on conviction. A threat to take action if work were not resumed in twenty-four hours was widely circulated, and the ultimatum had the effect desired. Nobody can accuse the Minister of hasty action ; indeed it is to be hoped that in any further troubles less latitude will be allowed. That promptitude is likely to produce good results was shown when a threat was made last month to call out tramway and omnibus workers in order to hold Sunday night meetings to consider the refusal of the Home Secretary to agree not to issue cab licences to women. The police placarded depots and garages with notices indicating that to cause or bring about a cessation of tramway and omnibus services used by munition workers would constitute a breach of Regulation 42 of the Defence of the Realm Act, while the Minister of Labour forwarded a lengthy telegram

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appealing to the men to take no action that would interfere with the transport of munition workers on the night shift and of soldiers travelling. Fortunately there was never any danger of the men obeying the behests of the agitators who caused the London County Council Tramways trouble in 1915, and who had signed an agreement with the London General Omnibus Company in 1913 that that company were not to be affected by disputes with other traffic organisations with whom they had not direct concern. The imposition of a penalty for breaking such an agreement ought to be made the subject of an amendment to the Munitions of War Act. This Act further requires revision as regards the period of 21 days allowed for referring a dispute to the Board of Trade, although no limit is given for the settlement itself. Delays are dangerous at a time when the nation's existence is at stake.

Youths Called to the Colours.

Future provision for the war has necessitated calling to the colours youths of eighteen years. In connection with this departure care should be taken that the devotion of these recruits to patriotic duty is not allowed to militate against their future prospects or those of the industries from which they are flocking. Their introduction to the world of work had progressed just sufficiently to disillusion them of the dreams that accompany liberation from school life. With a chance of active service in a number of countries when they attain the age of nineteen, they approach their year of training as the beginning of an adventure that promises freedom from the monotony of home and workshop life. Only the more thoughtful among them will perceive that the withdrawal from civil pursuits for perhaps two or three years is accompanied by danger to their efficiency as engineers, mechanicians, or workmen, thus placing the industries of the country at a disadvantage when nations return to peaceful rivalry. Undoubtedly military training will improve them physically, and those who return to civil life will also appreciate the advantages of discipline and its usefulness in everyday life. It may be hoped that the Army Council will not allow the improvement of the nation's greatest future asset to end there. In the old army every barrack had a regimental school and schoolmaster. The new army has two or three spare afternoons per week, but the conditions attached to two and a half years of war have not permitted the offering of educational facilities. There is no reason, however, why the teaching of subjects that will be useful as civilians should not be adopted as part of the military training. By that means the lads would be enabled to take up responsible positions in civil life instead of finding themselves as competitors for unskilled work. For a considerable portion of this teaching the staff and facilities are available within the army itself in such directions as the motor transport department and military railways. Shorthand, typewriting, and the elements of accountancy, which some of the youths may have taken up at evening schools, could also be taught. Indeed, the Army Council need only invite the co-operation of the practical men now at the head of the Education Department to enable them to dovetail civil education into military training. It is satisfactory to note that on March 28 the Secretary of the War Office announced that certain training reserve battalions have been organised for the training of these youths allotted to the infantry, that the staff of each unit has been selected with the object of advancing their welfare and education, and that a special syllabus of training has been drawn up. The question is one in which traction undertakings are concerned, and the respective managements are to some extent responsible for the creation of this manifestation of interest in the continued education of the lads, who since the institution of compulsory service have formed a large proportion of the operating staffs.

SUMMER TIME REINTRODUCED.

By an Order in Council the Government reintroduced summer time on the morning of Sunday, April 8, when the clocks were put forward one hour. It will continue until 2 a.m. on Monday, September 17. The innovation last year did not begin until May 21, the Bill not being approved by the House of Commons until May 8. The earlier resumption of Greenwich time this year was recommended by the Home Office Committee as a concession to Ireland, where some confusion was caused among agriculturists last year.

Summer time was reintroduced in France at 11 p.m. on March 24, and normal time will be restored on October 7.

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LIGHT RAILWAYS AND AGRICULTURE.

The present war has demonstrated one thing clearly, and that is the paramount importance of our great agricultural interest. To increase the home supply of wheat and corn, and, indeed, of all foodstuffs, is not merely a pressing matter for statesmanship, but is one to which attention must be specially directed after the war. In dealing with this question the importance of a cheap and rapid motor or railway service cannot be disregarded. Such a service is required for the carriage of manures, machinery, and supplies of all sorts for villages and farms which are at a considerable distance from any railway station, and for the quick transit of poultry, eggs, vegetable produce, and fruits to populous markets, and also for the establishment of rural industries. The Light Railway Act of 1896 at its passing was hailed as cheapening the procedure, construction, and working of a light railway system which was to benefit agriculture, but on the whole this Act has not realised the anticipations of its promoters. Light railways through agricultural areas are few, whilst those in urban areas which resemble tramways, and are dependent on large populations for their traffic, are far more numerous.

Light railways, though they are divided into three classes, yet are probably better classified by the Light Railway Commissioners in their reports into two classes, viz., those which resemble ordinary railways and those which for the whole or for a very considerable portion of their length use the public roads or streets in such a way as to allow some part of the road to be also used for wheeled traffic. The latter class are essentially the same as tramways, although subject to different considerations through being promoted under the Light Railways Act instead of under the Tramways Act. The Light Railways Act does not, it should always be remembered, hamper promoters like the Tramways Act; therefore the Act has been resorted to instead of the Tramways Act. Under the Light Railways Act any local authority except a Parish Council, singly or jointly, is empowered to apply, subject to certain restrictions, for a Light Railway Order. Not only have County Councils, Borough and District Councils power to advance money for this purpose, either by way of loan or as part of the share capital of a Light Railway Company, but the Act also empowers the Treasury to advance money by way of loan to a Light Railway Company at such a rate of interest as will enable such loan to be made without loss to the Exchequer, or in certain cases to make a free grant or a loan. No doubt the financing of light railways will, in common with many other enterprises, be affected by the increased value of money after the war, and other provisions will require to be introduced this year if the Act is amended or continued, as it should be. The Light Railways Act of 1912 conferred fresh powers, exercisable on the recommendation of the Development Commissioners, for the advance of money to public authorities and to various other bodies, persons, or companies not trading for profit for the purpose of making light railways and for the general improvement of rural traffic, but more now requires to be done.

With circumstances apparently favouring so essentially the promotion of light railways, the Act ought to have proved a great success. The fact, however, remains that its success has been extremely limited, and where it has proved successful it has been mainly in the development of tram roads. One of the causes of its failure may be seen in the effect of Section 9 of the Act, which directs the Board of Trade to consider any order submitted to them under the Act for confirmation with special reference to "The expediency of requiring the proposals to be submitted to Parliament." In the Staines and Egham case the Board insisted that the proposals of the promoters should be submitted to Parliament on the ground that the scheme would affect the returns of an existing railway, although in fact the returns affected could have been but small. Following this decision the Light Railway Commissioners rejected several applications on this ground, and promoters took alarm, and pending applications were withdrawn.

There is no question of Parliament's intention that agriculture should be benefited by the construction of light railways, for the Act declares that if the Board of Agriculture and Fisheries certifies that the making of any light railway would benefit agriculture in any district, or that it is necessary to establish communications between a fishing station or a village and a market, but that owing to the exceptional circumstances of the district the railway cannot be constructed without special assistance, the Treasury may make special allowances under special circumstances. One special circumstance is that landowners, local authorities, and other persons locally interested have by the free grant of land or otherwise given all reasonable assistance and facilities in their power for the purpose of the construction of the railway.

Whilst Parliament has been thus anxious to benefit agriculture by railway construction, the question is whether the Board of Trade in the interests of public safety have not made the conditions of working light railways too onerous, and, consequently, too expensive, for promoters, especially in the case of purely agricultural railways. The cost of the construction of a light railway before the war was between £6,000 and £11,000 a mile. It should certainly be considered whether the former figure is not too high. The Light Railways Act of 1912 amended and continued the principal Act for five years, so if it is to be continued fresh legislation is due this year.

It might be suggested that the whole subject should be dealt with in conjunction with schemes under the Development Act of 1909, the objects of which were to aid agriculture and rural industries by providing scientific research industries and experiments in the science, method, and practice of agriculture, including the provision of farm institutes to encourage forestry and the reclamation and drainage of land. Schemes which would provide for some of these objects would afford employment for thousands of men after the war, and at the same time would stimulate the United Kingdom to a larger production of foodstuffs. In any scheme a cheap method of transit will be found to be of the first importance. How far land settlement and colonisation could be included and the co-operation of the railway companies obtained is a matter for the various authorities concerned.

SUPPLY OF TRAMWAY MATERIALS.

Certain tramway materials which were originally intended for export, but have been held up by the Government, have been offered from time to time to the Tramways and Light Railways Association. It has been found possible in some cases to supply members from this source with materials which they required, and the Council have decided to issue weekly lists to the various managers giving particulars of materials:—(1) For sale from stock by tramways undertakings; (2) for sale from stock by manufacturers; and (3) required by members. In this way it is hoped that by means of interchange the application for priority certificates for new materials may be reduced. In the Journal of the Association for March the attention of members is particularly called to this matter, and it is hoped by the Council that good may result if all concerned inform the secretary (133, Tothill Street, Westminster, S.W.1) of their requirements.

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THE UNDERGROUND RAILWAY GROUP.

Notwithstanding the war, important changes have been taking place recently in connection with the Underground Electric Railway Group, in which, more particularly, we include the "Tubes" and the London General Omnibus Company. It is a matter of common knowledge that the Underground Electric Railways Company, through its holdings, controls the City and South London, the Central London, the London Electric Railway, the Metropolitan District Railway, and the London General Omnibus Company. Although these companies have been under one control for a number of years, they have to a large extent been operated independently, and this has not been good either for the travelling community of the Metropolis or for the shareholders of the various undertakings concerned. An arrangement under which the existing facilities for travel in and around London are placed at the fullest possible use of the public, at the cheapest possible rate, by a system of through bookings and interchange traffic, is the ideal system from the public standpoint. When, however, we had half-a-dozen or more different and independent companies each playing for its own hand, a system of working in the public interest, or even in the common interests of the companies themselves, was not possible. It was for this reason that the companies concerned secured from Parliament in 1915 the powers contained in the London Electric Railway Companies Facilities Act. From the revenue-earning and profit-earning point of view, the "pooling" arrangement permitted by this Act practically abolished the identity of the five companies comprised in the arrangement, that is to say, the five companies already mentioned above. The whole of the revenue earned by the five companies is put into a common fund, and from that common fund what are known as the "revenue liabilities" of all the undertakings have first to be provided. These include working expenses, prior charges, reserves, etc. The surplus then available, known as the "common fund," is divided in fixed percentages between the five parties to the arrangement. The agreement arrived at under the powers of the Facilities Act came into operation from the beginning of the year 1915, and the distribution of profits represented by the "common fund" was to be made as follows:—

	For the Year 1915.	1916 and succeeding Years.
City and South London Railway Company	2 per cent.	6 per cent.
Central London Railway Company	20 ,,	20 ,,
London Electric Railway Company	26 ,,	30 ,,
Metropolitan District Railway Company	12 ,,	12 ,,
London General Omnibus Company	40 ,,	32 ,,

The accounts published for the years 1915 and 1916 showed that the actual results of the first two years' joint operations were as follows:—

	1915.	1916.
Gross traffic receipts for the five companies	£4,924,000	£5,279,000
Other receipts	557,000	759,000
Total receipts	£5,481,000	£6,038,000
Working expenses and prior charges, otherwise known as "revenue liabilities"	5,030,000	5,531,000
Balance, representing "common fund"	£451,000	507,000

The only company of this group which is comprised within the system of Government control is the Metropolitan District. For the year 1914, as will be seen from the following table, several members of the group showed a reduction in their dividends, to be mainly attributed to the disorganisation caused by the outbreak of war.

UNDERGROUND DIVIDENDS, 1913-1916.

Company.	1913.			1914.			1915.			1916.		
	First Half.	Second Half.	Year.	First Half.	Second Half.	Year.	First Half.	Second Half.	Year.	First Half.	Second Half.	Year.
Central London Railway	3	3	3	3	2¼	2⅝	3	3	3	3½	3½	3½
City and South London Ordinary	¼	*Nil*	⅛	*Nil*	*Nil*	* *Nil*	*Nil*	*Nil*	*Nil*	1½	1½	1½
London Electric Railway Ordinary	1	1	1	1	¼	⅝	1	1½	1¼	1½	1½	1½
Metropolitan District Railway 2nd Pref.	2½	2½	2½	3	1	2	3	3	3	3	3	3
†London General Omnibus	16	20	18	16	16	16	12	12	12	10	6	8

* Only 2½ per cent. paid on 1901 and 1903 5 per cent. Pref. † Dividends paid free of tax.

For the year 1915 there was a distinct recovery, however. This improvement, so far as the railway members of the group are concerned, was more in evidence still during 1916. The Central London increased its annual dividend last year by ½ per cent. The City and South London is not only meeting its preference charges in full, but is paying 1½ per cent. on its ordinary stock for 1916, which is the best dividend recorded on this issue since 1912. Further, the London Electric has increased its annual dividend from 1¼ to 1½ per cent. in 1916. The District pays the same rate on its second preference, but the London General Omnibus has reduced its annual dividend from 12 per cent. to 8 per cent. These changes can, in the main, be traced to the alteration in the percentages of distribution of the "common fund" as shown above; in other words, the City and South London and the London Electric receive higher proportions, whilst the London General Omnibus receives a lower proportion of the aggregate surplus. The fact that the Central London has increased its dividend, whilst it receives the same percentage in 1916 as it did in 1915, simply indicates that the "common fund" was rather larger for 1916 than the corresponding figure in 1915, as shown above. Another point is that the reserves, etc., appropriations of the group were increased by £45,000 over and above the transfers from profits made in 1915. Latterly, of course, owing to petrol restrictions and other difficulties, omnibus services have had to be restricted, and this is not a favourable development from the point of view of gross revenue. Even this change may, however, enable the London General Omnibus to concentrate more efficiently on the more remunerative routes, and perhaps save some expenditure to compensate. What is more important, however, is that such traffic as may be lost to the omnibus is necessarily mainly diverted to the underground rail-

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ways, and tends to swell their traffic. Whatever else the Zeppelins may have done, there is not much question that they have advertised in the most practical way the "Tube" facilities to many thousands of people who were not fully acquainted with them. The darkened streets throughout the last two winters, due to the same cause, also acted as a strong incentive to the use of the "Underground." The "travelling habit" thus induced is rarely lost, and such traffic, which we believe represents a very large item indeed, is likely to represent a permanent expansion in the earning capacity of the "Tubes." How far the remarkable increase in through facilities from one end of London to the other has swollen traffic it is impossible to say, but there is no doubt that in this direction the Facilities Act of 1915 has done much good work. One of the few opponents of that Act was the London County Council, which passed various recommendations to the Parliamentary Committee at the time the bill was before Parliament. One such recommendation passed in May, 1915, was that the bill "should not become law unless accompanied by adequate safeguards for the interests of the Council and the travelling public of London." Further resolutions were passed in June, 1915, suggesting that any agreement under the bill should be subject to the approval of the Board of Trade, and "that the Council shall be afforded an opportunity of submitting its views thereon." Another recommendation made at the same time was that the Act should only remain in force for the period of three years; which, bearing in mind the very principle of the whole proposal, namely, unification of disjointed systems, was an absurdity. Fortunately, Parliament was not influenced, as indeed it rarely is, by the meddlesome action of the London County Council. In an attempt to show that its opposition was well-timed, the Highways Committee of the Council some months ago submitted a report on the Act of 1915. The Highways Committee, in the course of their report, deal with the actual operations of the Act in a manner with which we can find no fault; but we entirely disagree with the concluding statement that "the criticisms of the Council of the proposals in the bill have been shown to be justified." The following paragraph from the Highway Committee's own report seems to give the best possible testimony to the excellent results of the Facilities Act:—

> The main point which emerges from a study of the traffic figures of the combination is that, in spite of the increased cost of wages, coal, and other expenses of operation, it has been possible to deal with the traffic, which has produced substantially the same amount of revenue and has been probably not much less in volume, in such a way as to produce a small increase in both surplus on working and net earnings.

If we understand the above paragraph aright, it means that the "Unified Underground" has been able to work more efficiently, and by so doing has avoided the necessity for an increase of fares at a time when the cost of every other public service and commodity has increased to a very serious extent. Moreover, as the County Council's own Highways Committee shows in its report, the Royal Commission on London Traffic in 1903 urged the policy of unification; and, indeed, on various occasions in recent years Parliament has urged the principle of co-operation as more desirable in the public interest than the old policy of reckless competition. We venture to suggest that the future operation of the Facilities Act will still further demonstrate that the London County Council's suspicions and criticisms were unjustified and contrary to the public interest.

Although the efficiency of the administration of this group, together with the advantages of the Facilities Act, have staved off any increase in charges to the public, it is only too clear that a step in this direction may now be inevitable. A hint to this effect was given by Lord George Hamilton at the meeting of the Underground Electric Railways, and from many points of view it appears to be essential to the efficiency of the transit system of London under war conditions.

CORRESPONDENCE.

Profitable Limit of a Penny Stage.

To the Editor of The Tramway and Railway World.

Sir,—I have read with interest the article on halfpenny fares on tramways in your monthly issue of March 15, 1917. I agree with your correspondent that the basic fare of all tramway systems is the penny fare, but I do not agree with his deduction that a passenger can only be carried 1·75 miles for 1d.

I may be wrong, but this is my process of reasoning:—The total cost of running a tramway can be practically divided into two categories, viz., those fixed charges which have to be met whether a car is running empty or full, and those variable charges which depend upon the weight of the passengers carried.

In the first category there come such charges as motormen's and conductors' wages, ticket inspecting, office expenditure, overhead equipment, etc., and interest and sinking fund on the capital cost of the undertaking. In the second, or variable category, come the wear and tear on cars and permanent way and the charge for current consumed in running the cars.

Take the case of the majority of provincial tramway undertakings, where most of the lines radiate from the centre of the town and run from three to four miles, as a maximum, to the outlying districts, and where the size of car usually used weighs practically 12 tons when empty. Such an average system is the one I have the pleasure of looking after, and I will therefore use the figures relating to this system for the year ending March, 1916.

From these figures I find that variable costs, as mentioned above, amount to £10,947, and the mileage run during the year was 892,234. The weight of our cars empty being about 12 tons, it would therefore appear that 10,706,808 ton miles of energy were used in moving the cars themselves without the weight of passengers, from which it would appear that it costs to run an empty car 2·95d. per mile (or ·2456d. per ton mile) in variable costs.

Taking the average weight of a passenger to be one hundredweight, it would appear that it costs ·0123 to convey a passenger one mile after he has first paid his proportion of the fixed and variable charges mentioned above. The fixed charges amount to £23,837, and the passengers carried 9,988,700, so that the proportion per passenger for fixed charges amounts to ·57d. and for variable charges to ·26d., a total of ·83d. per passenger.

My argument therefore is that after a penny passenger has paid his proportion of fixed and variable charges amounting to ·83d. for his first mile, that it only costs a fraction of a penny (viz., ·0123d.) to carry him each extra mile, provided the car is not so full that his presence prevents another passenger from boarding the car. This proviso is, of course, absolutely essential.

As I have said above, I may be wrong in my deductions and am open to correction, but it is an interesting point, and I should much like to hear the views of other managers upon it.—Yours faithfully,

L. E. Harvey,
Tramways Manager and Engineer.

Ilford Urban District Council,
March 26, 1917.

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UNDERGROUND RAILWAY WELFARE WORK.

NEW CLUB PREMISES FOR WOMEN EMPLOYEES.

A notable step forward in plans for the benefit of employees is marked by the club premises which have recently been established close to Earl's Court Station, London, S.W., for the women employed on the administrative staffs of the London underground railway companies and of the London General Omnibus Company. The handsome and commodious premises have been provided by the associated companies. The building, which was originally a large dwelling-house, has been so adapted as to provide an excellent suite of large rooms, together with ample kitchen accommodation.

At the headquarters of the companies, Electric Railway House, Westminster, and at the Earl's Court and Oxford Circus ticket sorting offices some hundreds of women and girls are employed. Even before the war they were numerous, but now their numbers have much increased. Most of them live at such distances from their places of employment that it is not possible for them to return to their homes for luncheon, and during the last year or so the question of prices in "places of public eating"—to use the Food Controller's phrase—has become a serious matter. The authorities at Electric Railway House, ever solicitous for the welfare and comfort of their staff, accordingly entered upon this experiment of providing a lunch and social club. Though it has been in existence for only a few weeks, it has already proved a great success. It is now used by about 250 women and girls.

The building consists of five storeys, and has a direct entrance for members from Earl's Court Station. The basement contains kitchen and domestic offices. The cooking apparatus, which is entirely electrical, includes four baking ovens, large boilers and steamer, boiling plates, grill, etc., suitable for cooking the requisite number of meals. The electricity is obtained from the railway supply, so this is one more use to which the great turbines and generators in the Chelsea power-station are put. A special electric cable is run from Earl's Court sub-station into the club house. The pressure used is 220 volts, alternating current. The ovens were made by the British Electric Transformer Company, and the boilers and hot cupboards by the Jackson Electric Stove Company. Arrangements have been made for additional plant to be supplied at an early date, which will enable about 300 meals to be supplied.

There is also a dining-room (with servery) in the basement, capable of seating 40 persons. On the ground floor are two other dining-rooms accommodating 80 people. These have their own servery, and a lift direct to the kitchen. The first floor is taken up by two large, comfortable rest rooms and a small library. The rest rooms are supplied with easy chairs and current periodicals, and the library, which at present is only a nucleus, is well patronised, as the members are allowed to take the books home.

One of the Rest Rooms.

The whole place is so clean, comfortable, and restful that the staff find their early afternoon visit to it a welcome contrast to overcrowded restaurants and tea-rooms. The alterations to the building were carried out by the architectural sub-department, under Mr. Z. E. Knapp, underground railway manager for maintenance and construction.

Under the arrangements which have been made the employees for whom the club is intended have no difficulty in using it. Those employed at Earl's Court are, of course, practically on the spot. Those whose offices are at Westminster and Oxford Circus are provided with facilities to enable them to travel to and from Earl's Court. With such a frequent and fast service of trains as is available only a few minutes

Dining Rooms at the Club for Women Employees of the Underground Companies.

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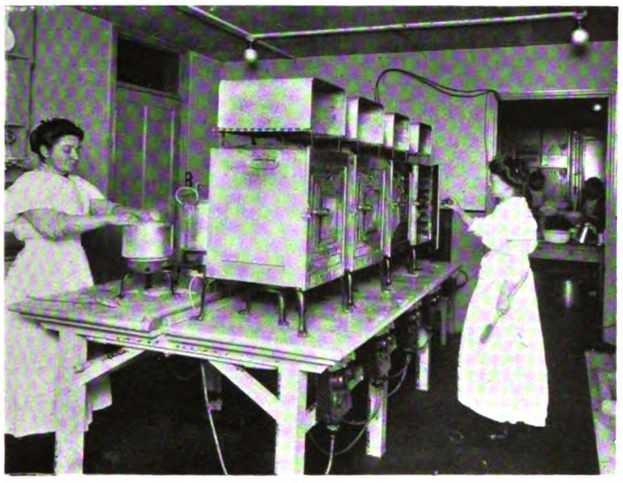
out of their hour or hour and a quarter for lunch are taken up in going and returning. To prevent any tendency to crowding in the dining-rooms, arrangements are made for the members to travel by particular trains so as to arrive at stated intervals.

As the object is to provide meals at the lowest possible cost, no table waitresses are employed. Serving counters are installed adjoining the dining-rooms, and there each member is served with her portion of joint, etc., and sweets, which she takes to a table in the dining-room. The tables are well equipped with linen, cutlery, etc. The quality of the food is excellent, while the price is only a fraction of that charged even in popular restaurants. No subscription or fee of any kind is payable by the members.

The premises are at present opened on two evenings a week, and those who care to go to the club at these times may obtain light refreshments. Occasional concerts, arranged by a committee of the club members, are held, and the first was very successful, about 120 members being present. While the business of the club is in the care of a manageress, a committee of the members has been formed to exercise general control.



Electric Baking Ovens in the Kitchen.

A party of representatives of the technical Press were recently given an opportunity of inspecting the premises. Mr. H. E. Blain, operating manager of the associated companies, who had hoped to be present, was detained by other urgent engagements, but his place was efficiently taken by Mr. S. J. Webb, passenger agent, who gave an interesting account of all that had been done for the welfare of the women employed on the administrative staffs of the companies.

ELECTRIC POWER SUPPLY INQUIRY.

The following are the members of the Co mittee appointed by the President of the Board of Trade to consider and report what steps should be taken, whether by legislation or otherwise, to ensure that there shall be an adequate and economical supply of electric power for all classes of consumers in the United Kingdom, particularly industries which depend upon a cheap supply of power for their development :—Mr. F. Huth-Jackson (chairman), Mr. H. Booth, Mr. James Devonshire, Mr. G. H. Hume, Mr. John Kemp, Mr. H. H. Law, M.Inst.C.E., Mr. C. H. Merz, Sir Charles Parsons, K.C.B., Sir John Snell, M.Inst.C.E., Alderman C. F. Spencer, and Mr. A. J. Walter, K.C. The secretary is Mr. M. J. Collins, Board of Trade, 7, Whitehall Gardens, London, S.W.1.

Proposed All-British Steel Syndicate.—The Central News states that prominent steel-makers throughout Great Britain are considering a scheme to form an all-British syndicate of steel-makers, with a view to shutting the door effectively against foreign steel-makers on the conclusion of the war. Merchants on their part have formed themselves into an association to safeguard their interests.

AVOIDING PAYMENT OF FARES.

With services reduced on account of shortage of staff, tramway undertakings have had to deal with considerable overcrowding at rush periods. This pressure has resulted in an increase in the number of passengers who avoid payment of fares, especially for halfpenny and penny stages.

Attention has lately been directed to the problem by a committee of the London County Council, with the result that a notice has been placed in the cars headed "Avoiding Payment of Fares." It directs attention to "Section 51 of the Tramways Act, 1870, which provides for the infliction of a penalty on a passenger who avoids, or attempts to avoid, payment of the fare, or who, having paid the fare, travels beyond the stage for which the ticket has been issued without payment of the additional fare." As the notice is boldly printed, it should exercise a deterrent effect, provided it is permanently displayed. Its wording is explicit, and it should meet the case of those undertakings that may not have adopted the later by-law which places upon the passenger the obligation to pay the fare, whether demanded or not, before leaving the car. Several tramway authorities have adopted this by-law during the past two years.

The collection of fares is likely to be facilitated on the through tramways of the West Ham and East Ham Corporations and Leyton, Ilford, and Bexley Urban Councils by the recent decision to discontinue halfpenny fares for adults. The foregoing authorities have through running agreements with the London County Council, and the latter body will shortly receive a report from the Highways Committee setting forth their recommendation as to the continuance or discontinuance of halfpenny fares on the Council's portion of the through running routes of the above authorities.

A method adopted a few years ago by a large northern tramway undertaking for lessening the pressure of halfpenny fares was to cease to issue those tickets at terminal ends. At Hull the cars are stopped some distance short of a busy stage point, so that the conductor may be enabled to complete his or her round. The necessity for this practice is evident judging by a statement made at a ratepayers' association meeting by the chairman of the Tramways Committee. It was to the effect that there is a leakage of £3,300 per annum, due to passengers avoiding payment.

On the Manchester cars the conductors are able to devote their whole time on busy sections to the collections of fares, as they are given the aid of a boy or girl to take charge of the bell and call out the stopping places. A similar course has lately been adopted at Birmingham and Salford during the evening rush period by the voluntary employment of boy scouts and grammar school pupils, who regard the task as war work. This innovation has proved so successful on the Edmund Street route at Birmingham that scouts from other divisions of the city have been invited to assist in the same manner.

Special consideration has been given to the leakage of revenue at Northampton through passengers failing to pay their fares. The Tramways Committee have directed the general manager, after consulting with the deputy town clerk, to prosecute any person riding on the cars without having paid the fare. Notices have been posted in the cars that the obligation imposed by the by-laws is for the passenger to pay the fare, whether demanded or not, before leaving the car. As reported in our issue of March 15, the Plymouth Tramways Committee have provisionally adopted a by-law rendering it obligatory for each person to pay the fare on leaving the car or on demand before leaving.

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MEANS OF LONDON TRANSIT.

UNDERGROUND RAILWAYS & L.G.O.C. GROUP EFFICIENCY MEETING.

At the monthly efficiency meeting of the operating department of the London "Underground" group, which was held on March 26, at the L.G.O.C. Training School, Milman's Street, Chelsea, Mr. E. H. Blain, operating manager, presided over an attendance of some 250 members of the controlled staffs.

A paper on the "Means of London Transit" was given by Mr. John C. Mitchell, F.C.I.S., treasurer to the companies, this being illustrated by an exceedingly interesting collection of slides. After describing the various definitions of the term "London" in use in connection with local government, police, water, and other administrative purposes, Mr. Mitchell gave an historic review of the means of London transit so far as concerned omnibuses, railways, and tramways, commencing with the Shillibeer horse omnibus of 1829, and tracing its evolution through the various types of horse vehicles to the earlier types of motor vehicle, and the present motor omnibus so familiar on the streets of London. Interesting particulars with regard to omnibus traffic, from the days when one shilling was charged from Paddington to the Bank, the fare including the provision of light literature, were given, also a description of the sale of "times," the term under which the goodwill to the "right" of operating an omnibus on a certain time-table on a certain route was known. The history of the London General Omnibus Company through its various developments, of its principal rival the London Road Car Company, and of the various short-lived motor omnibus companies which sprang up some few years ago, until the present combined attempt to provide the best possible transit facilities, proved exceedingly interesting, and Mr. Mitchell's personal connection with the movement enabled him largely to quote from his own knowledge.

The second part of the paper dealt with the development of the various railway systems in London, commencing with the first appearance of trunk-line railways at a metropolitan terminus and the establishment of the Metropolitan, the District, and the various tube lines, and the final conversion of the underground railways from the old days of dirt, smoke, and sulphur, to the modern electrified working. The final section of the paper dealt with tramways in London, and described the ramifications of the various Council and company undertakings now in operation.

Statistics that were cited showed the enormous stimulus to the travelling habit which was given by the improvement of facilities, and the offering of transit at reasonable fares; and the whole paper formed an admirable survey of the history and development of transit in London.

The paper was followed by a film of the newly-electrified portion of the L. & S.W. Railway, kindly lent by the latter, after which a discussion was opened by Mr. W. E. Blake, superintendent of the line of the Underground Railways, who, by means of five interesting charts, showed the manner in which these had developed within five defined periods, the curious intermingling of main-line railways with the underground railways becoming more apparent as each step was traced. Mr. J. P. Thomas, general superintendent of the L.G.O.C., then outlined a number of directions in which development in the future should take place, noticeably in connection with economy and scientific application of the use of coal and motor fuel, and an exceedingly interesting evening was closed by a vote of thanks to Mr. Mitchell, passed on the motion of Messrs. W. C. Burton and Murray Griffith, two members of the Boards of Directors.

TRAFFIC DIFFICULTIES.

GOVERNMENT COMPLAINT OF BAD TIME-KEEPING.

With the steady drain of labour caused by the Military Service Act, it is not surprising that great difficulty is experienced in maintaining tramway and omnibus services. The trouble is increased by bad time-keeping on the part of many of the employees, their unpunctuality and absence being attributed to long hours, illness, and bad weather.

In connection with the recent one-day's strike of the Newport tramway employees, Councillor J. Moxon, chairman of the Tramways Committee, stated that the department had encountered great trouble in maintaining the service, because the men were not keeping time. Many munition workers had lost "quarters" because they had not had the cars to take them to their work. Complaints had been made by the Government for weeks past.

Two causes led to the Newport strike, viz., the Tramways Committee's decision to train women as drivers owing to the shortage of motormen, and a demand for increased pay by the present employees. The latter point has been conceded, but on the first-mentioned matter the chairman of the committee said they could not promise that women would not be employed as drivers. The demands made by the Director of National Service and the Ministry of Munitions were increasingly urgent, and the management must still further dilute male labour by substituting women, not only as drivers and conductors, but as cleaners. He denied an allegation that the committee would not employ discharged soldiers, and said that forty were already working as motormen, or one-half of the male staff.

A further depletion of the employees on every tramway is likely to result from the introduction of the Military Service (Review of Exemptions) Bill. The object of the measure is to make a re-examination of any man who is for the time being exempted on medical grounds from the operation of the Military Service Acts, 1916, or of any man or officer within the age limit of 41 years who has been discharged in consequence of disablement or ill-health. The War Office expect to secure 50,000 men for service of one sort or another from among men who have been discharged. This drain must inevitably affect tramways if their extensive employment at Newport can be taken as a criterion. The substitution scheme is also likely to come to an end.

On the question of substitution, Alderman Fletcher, chairman of Wigan Tramways Committee, has stated that the army had taken the most suitable men, and it had been found impossible to substitute others. The department could not employ women to drive, and if men were off sick, as they had been through the weather, which had also brought about exhaustion in some cases, what were they to do? They had had 19 men off on one morning, including 11 motormen. The shortage had become so great that some of the sections would have to be closed down on Sundays.

Southampton Tramways Committee lately improved the service on the Shirley section. Reporting on a further request from that locality the general manager, Mr. W. T. Robson, said that in view of the almost universal complaints which reach one from other towns referring to the diminution and irregularity of tramway services, the increased service has, he is afraid, had the effect of falsely minimising the difficult conditions under which tramways are now carried on. In reality, this increased mileage represents an enormous amount of hard work and long hours on the part of a willing but sadly depleted staff, who might reasonably receive a larger share of assistance from the public in the still more difficult times ahead. Essential conditions for a regular service were a plentiful supply of motormen, well-lit streets, undisturbed and efficient maintenance of plant, and plenty of cars. As all these were lacking, the tramways committee assented to Mr. Robson's suggestion that by means of notices on the cars and in the newspapers passengers be requested to avoid the rush times as far as possible, and that large firms and business houses be invited to assist in spreading rush traffic over a longer period.

SHEFFIELD'S WAR TIME TRAFFIC.

The traffic returns of the Sheffield Corporation Tramways and Motor Omnibuses for the year ended on March 25 show a greater increase than any other traffic undertaking in the United Kingdom for the corresponding financial year, except those of Glasgow and London. Up to March 25 Sheffield shows an increase of £76,040 in the aggregate receipts. In some weeks there has been an increase of more than £1,700 per week as compared with the corresponding week of last year. This result is due to the vast augmentation of war industries in the city and district. The cars and omnibuses are carrying 43 per cent. more passengers than was the case before the war. The working expenses, however, have increased 28 per cent. As an indication of the increased traffic the returns for February, 1916 and 1917, may be quoted. In the first-mentioned month the receipts from 10,011,928 passengers were £37,393, as against £42,639 from 11,422,511 passengers for February, 1917. At the outset of the war there was a falling off in the traffic, but by January, 1915, the decrease had been converted into an increase. This has since continued, and the difficulty which has confronted the general manager, Mr. A. R. Fearnley, and the Tramways Committee has been to provide sufficient cars to deal with it. Recently the Corporation were able to purchase a few cars from the London County Council, the latter authority being glad to dispose of these vehicles owing to the shortage of motormen. At the beginning of the war the Sheffield tramways suffered a great reduction of their staff owing to the liberal manner in which the department has always provided employment for discharged soldiers. The department speedily lost the services of 147 motormen and conductors who were recalled to the colours. The appeal for recruits for the New Army was a further blow to the fulness of the services, resulting in a shortage of motormen. By the end of the year 280 men had enlisted. It was not until the summer of 1915 that women were employed as conductors, and now there are 900 women out of a total staff of 2,020 persons. The women have taken the place not only of conductors, but of car cleaners, clerks, timekeepers, and cashiers, and they are also acting as ticket inspectors. In two of the depots the whole of the work is performed by women.

New Russian Railways.—The Russian Government are considering a project for the construction of 70,000 kilometres of new railways during a period of ten years. The works will be commenced immediately after the signature of peace.

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NEW AND PROSPECTIVE WORK.

A scheme for a new generating station is to be submitted to Colchester Council.

Todmorden Corporation propose to expend £10,000 on new machinery for the electricity works.

It is proposed to reconstruct the tramway track in County and Manchester Roads, Swindon, as soon as possible.

Permission to borrow £27,500 for extensions at the generating station has been applied for by Kirkcaldy Council.

The Local Government Board have sanctioned the borrowing of £32,703 for extensions to the generating station at Bedford.

For the extension of the electricity plant at Barnsley, the Corporation are asking for permission to borrow a further £4,000.

A loan of £10,000 is being applied for by Halifax Tramways and Electricity Committee for the provision of a new boiler, economiser, etc.

Mexborough Council propose to ask the Treasury for authority to raise £9,500 for electricity works extension, subject to the sanction of the Local Government Board.

Battersea Council have asked the London County Council to construct a junction line between the tramways in Battersea Park and Battersea Bridge roads at the earliest possible period.

Halifax Highways Committee propose to draw the attention of the tramways department to the condition of the paving of the margins of the tramway track in various parts of the borough.

Rotherham Corporation have applied for sanction to build and equip a new generating station, and the Electric Light and Tramways Committee have been authorised to accept contracts for the work.

Representatives of Keighley and Bingley Tramways Committees have met to consider the question of linking up, after the war, their two tramways over the intervening two miles between Stockbridge and Morton Lane.

Huddersfield Tramways Committee are considering a suggestion for an extension of the tramways to two places adjacent to the moors, and the introduction of toast-rack cars in order to give facilities for country outings.

Mr. W. J. H. Wood, borough electrical engineer at Bolton, has been invited to act as consulting engineer to Rochdale Council for three months, in order to prepare a report on the steps required to meet the demands for electricity.

Farnborough Council have assented to a horse tramway being laid by the Aldershot military authorities from Farnborough station to a factory. It will be used for the conveyance of material, thus economising transport and petrol.

The Local Government Board have sanctioned the borrowing of £17,128 for two boilers and other plant at the electricity works of Leeds Corporation, and the Ministry of Munitions has issued a permit to allow the work to proceed.

At an estimated cost of £27,225, the Loughborough Council's generating station plant is to be extended. The work will include the provision of additional boilers and a larger turbo set, which are necessary in view of next winter's requirements.

Dundee Tramways Committee and the School Board have agreed to a scheme for the construction of a siding to the school for defective children at Balgray Road at a cost of £580. It is proposed that the board should make a payment of 5 per cent. annually on the outlay for twenty years.

Doncaster Electricity and Tramways Committee have reported that estimates show that on the termination of the war capital expenditure will be required to the amount of £19,050. The work will include the doubling of the Balby track at an estimated cost of £10,000, and car shed extensions at about £2,000.

Middleton Corporation have submitted to the Board of Trade a recommendation by their electrical engineer to connect the generating station with the Manchester Corporation electricity undertaking, thereby considerably reducing the present plant and entailing the provision of converters to deal with a bulk supply.

In order to provide for the transport of a large number of war workers at a factory recently established, the Newport Tramways Committee recommend the extension of the tramways from Pill terminus to the Alexandra Docks, the installation of an additional crossover, and an extension of the Clarence Place Siding at an estimated cost of £13,000. The committee also advise that the Ministry of Munitions should be asked to use their influence with the railway companies to cross the railways at Pillgwenlly, and also to contribute to the cost of the scheme.

Preston Corporation have adopted their Tramways Committee's suggestion that Mr. J. F. Simpson, the manager and electrical engineer, should continue his investigations into the question of providing a supply of power for local industries in view of the future development of the town. In his annual report on the tramways, Mr. Simpson states that the increase of traffic had necessitated the use throughout the greater part of every day of the whole of the generating plant, so that there was no reserve available in case of a breakdown of either engine. "Apart from the need for reserve plant," he adds, "the increased service rendered necessary by the growth of traffic will shortly load the existing generators to their full capacity, and additional plant is urgently required."

RAILWAY ELECTRIFICATION.

The North Eastern Mineral Line.—Lord Knaresborough, at the annual meeting of the North Eastern Railway, stated that the experience in working the Newport-Shildon mineral line by electricity had been satisfactory.

The Manchester-Bury Service.—The annual report of the directors of the Lancashire and Yorkshire Railway refers to the electric trains on the Manchester and Bury line having been inaugurated on April 17, 1916. The report adds that the service has been maintained with every satisfaction to the management and passengers. These observations were confirmed by Sir G. J. Armytage in his remarks as chairman at the annual meeting.

North London Railway.—Reference to this link from Broad Street and Kew with the London and North Western suburban electric system was made at the annual meeting of the North London Railway Company by Lord Rathbone, the chairman. The falling off in the passenger traffic had been arrested, he said, and until fares were raised by the Board of Trade Order there were increases of traffic week by week since the opening of the electric system on October 1 last.

Brighton Main Line Scheme.—The directors of the Brighton Railway have not abandoned their intention of extending the electrification of the main line from Croydon to Brighton. At a meeting of the Brighton Season Ticket Holders' Association the mayor stated that after the war the company intended to proceed with the work and also to double the permanent way. The latter work has already been accomplished over a considerable portion of the railway.

Surpassing Success of the South Western Conversion.—In the directors' report on the London and South Western Railway for 1916 it was stated that during the year £144,000 had been expended on account of the electrification from Waterloo to the Thames Valley. Certain work remained to be done so that the actual cost, approximately, would be £1,365,000. Experience of the electrified portion of the suburban lines had been in every sense satisfactory. Mr. Hugh Drummond (chairman) remarked at the annual meeting that the electrification had surpassed their expectations. During the last six months of the war the number of local passengers carried, including season ticket holders, showed an increase of 4,085,328, or, if Sundays were included, an average increase of 22,208 passengers daily.

London and North Western Suburban Lines.—Sir Gilbert Claughton, presiding at the annual meeting of the London and North Western Railway, made a reference to the extensive suburban electrification scheme. Recalling the opening of the Bakerloo Tube extension to Queen's Park in February, 1915, he said that arrangements were afterwards made, pending the opening of the through route to Watford, for certain of the Tube trains to run through from Queen's Park to Willesden, where connection was made with the main line and local London and North Western trains. After much unavoidable delay in the carrying out of the contracts owing to the war, the new electric line between Willesden and Watford had been complete for some time past, but they had not been able to obtain delivery of the rolling stock. Meanwhile, the line had been used by steam trains, and had been of immense advantage in enabling the main lines to be kept free for the ever-increasing through traffic. Arrangements, however, had now been completed for a through service of electric trains from Watford to Queen's Park, and thence over the Tube railway to the Elephant and Castle, by the use of the Tube company's stock until they could obtain delivery of the joint stock which had been on order so long. The electric services of trains between Kew and Richmond and Broad Street commenced to run on October 1 last, and had given some promise of a return of the large passenger traffic which that railway formerly enjoyed, but, of course, they could not look forward to the complete fulfilment of their hopes until the whole scheme of these electrified lines was complete, and that, he was afraid, they could scarcely expect until after the war.

Women as Tramcar Drivers.—Provincial newspapers report that strong protests are being made in some of the West Midland towns to a proposal of the military authorities that women should be employed as tramcar drivers in order to release men for military service. Some time ago the Ministry of Munitions made inquiries with the object of ascertaining how many tramcar drivers could be released if women were secured to take their places, and since then the suggestion has been further considered. In normal conditions no one would wish to employ women for the purpose, but it will doubtless become necessary to make further drafts on tramway employees, and it is probable that the number of towns where women are now driving cars will be largely increased. Their success in Glasgow indicates, at least, that women can be employed on the front platforms without serious danger to the public.

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ENGINEERING STANDARDS COMMITTEE.

The chairman of the committee, Sir John Wolfe Barry, K.C.B., F.R.S., has accepted the invitation of the Council of the Institution of Civil Engineers to give the "James Forrest" lecture on Wednesday, May 2, at 5.30 in the afternoon. As the initiator of the organised movement of standardisation in this country, the lecturer has very appropriately taken as his subject: "The Standardisation of Engineering Materials and its Influence on the Trade and Prosperity of the Country."

The growth of the principle of standardisation has been due in great measure to the steady work of the Engineering Standards Committee during the past 16 years, covering, as it does, most of the branches of engineering practice. The lecturer intends to draw particular attention to the new and important step taken by the committee, which has for its object the furthering of British trade abroad through the wider dissemination in the British Dominions and in foreign countries of the British Standard Specifications translated into French, Spanish, and Russian. Mention will also be made of the local Standards Committees which are being formed in some 12 countries abroad, and lastly of the fact that, when the necessary arrangements can be completed, British Standard Specifications will be available to the public, both in their English and foreign editions, at a flat rate of one shilling each, or its equivalent in foreign moneys.

In connection with this new development we are informed that the appeal which the committee has lately issued to the engineering industry of the country has, so far, resulted in the receipt of contributions amounting to over £12,000 from the leading technical institutions, trade associations, and manufacturing firms, and that H.M. Treasury has quite recently intimated the intention to ask Parliament to grant the committee a sum of £10,000 for this special purpose. We feel sure that all will agree as to the benefits which are bound to accrue to British trade and to the country at large through the widening of the scope of the committee's activities now proposed, and we confidently expect that all those who are interested in the development of the export trade of the country will co-operate with the committee in every way, and thus ensure the complete success of this important movement.

HIGHER FARES NEEDED AT BELFAST.

The Tramways Sub-committee of Belfast Tramways and Electricity Committee are considering a suggestion by the general manager, Mr. J. S. D. Moffet, with the object of increasing the revenue of the tramways undertaking. It is that the stages should be shortened, that the fares on the existing ordinary penny stages should be increased to 1½d., giving a distance of about 1½ miles for that sum; that police and post office privilege tickets and children's halfpenny school tickets should be abolished, and that the issue of 2d. return tickets in the earlier part of the day should be done away with. The 2d. return tickets cover a distance of 7¼ miles. The revenue account for the eleven months ended February 28 shows that the total expenses amounted to £168,651, as compared with £145,682 for the corresponding period of 1915-16. The total revenue is £271,800, as against £253,000, an increase of £18,800. The revenue per car-mile is 11·56d., as against 11·12d., which is the largest revenue for eleven months since the Corporation took over the undertaking. The working profit for 1916-17 was £107,715, as against £111,830 for the previous year. The increase of £22,969 in the expenditure is made up largely of the extra amount paid in wages and war bonuses, rates and taxes, maintenance of the permanent way, and electrical equipment. The total capital charges are £92,000, as against £87,000, an increase of £5,000. Adding the increased working expenses, there is an increase of £28,000 in the total expenditure. Mr. Moffet pointed out in his report that unless some means could be found of securing a higher return per passenger there was a likelihood of the department requiring assistance from the rates rather than being in a position to give relief to the rates. That this should be the case in face of the fact that the revenue for the year would easily constitute a record figure was not surprising, seeing that during the past six years the return per passenger had gradually fallen. Whereas in 1912 the return per passenger was 1·052d., in 1917 it had fallen to 1·011d., a difference of ·041 of a penny, while the cost had increased from ·964d. to 1·031d., or ·067 of a penny. The money equivalent of this variation was over £29,000 on the number of passengers carried during the current year.

Temporary Offices of the Institution of Electrical Engineers.—Their premises on the Victoria Embankment having been taken for the use of a Government department, the Institution of Electrical Engineers have taken temporary offices at 1, Albemarle Street, London, W.1.

All German Railways under Military Control.—According to Reuter's Amsterdam correspondent, an Imperial Order has been issued placing the entire railway system in Germany under the chief of the field railway system.

BRISTOL TRAMWAYS AND CARRIAGE COMPANY.

The directors' report for the year ended December 31, 1916, shows that the gross receipts amounted to £555,907, and the net revenue, including the balance brought forward, to £110,516. The details are set out in the appended table, in which comparison is given with the three preceding years. Taking the securities at their market value on December 31, the reserve fund stood at £294,349, and with the addition of £30,000 for the current year it will be increased to £324,349. The receipts of the tramways department show an increase of £6,241, or 2½ per cent., and those of the carriage department have increased by £35,552, or nearly 14 per cent. The total number of passengers carried by the cars and motor omnibuses was 60,628,342, an increase of 355,942. No further development has taken place during the past year with regard to the Bristol Corporation's option of purchasing the undertaking, beyond the obtaining by the Corporation of an Order from the Board of Trade to extend the time for exercising such option to October 31, 1917.

	1916.	1915.	1914.	1913.
RECEIPTS—				
Tramways department	£254,597	£248,355	£239,651	£243,686
Carriage department	294,081	258,530	209,512	174,701
Sundry receipts...	7,229	5,500	5,611	5,429
	£555,907	£512,385	£454,774	£423,816
EXPENSES —				
Traffic expenses...	£187,567	£175,415	£174,623	£164,810
General expenses	88,472	75,916	58,947	49,275
Renewals, repairs, and maintenance	174,408	162,189	138,615	129,498
	£450,447	£413,520	£372,185	£343,583
Net revenue ...	£105,460	£98,865	£82,589	£80,233
Balance from last account	5,056	—	—	—
Total	£110,516	£98,865	£82,589	£80,233
Interest	£27,598	£30,502	£30,638	£27,443
Interest carried to reserve fund ...	4,563	4,365	4,468	4,408
Div'd on 4% Pref. shares	15,542	17,333	18,458	18,833
Interim div'd on Ord. shares ...	10,052 (5 p.c.)	8,984 (4 p.c.)	9,396 (4 p.c.)	9,417 (4 p.c.)
Final div'd for half-year on Ord. shares	13,125 (7 p.c.)	12,625 (6 p.c.)	11,328 (5 p.c.)	11,771 (5 p.c.)
Addition to reserve fund	30,000	20,000	8,301	8,361
Carried forward ...	£9,636	£5,056	—	—

Mr. S. White, the new chairman, presided at the annual meeting on March 19, and gave an interesting account of the work of the year. In conducting the tramway and omnibus services, the chairman said they had recognised that they must facilitate the convenience of workpeople and others engaged in the production of munitions or on work of national importance, although war conditions necessitated the curtailment of ordinary services, particularly at certain hours. It was, however, extremely satisfactory to find that the traffic receipts had been more than maintained. The company had refrained from raising fares either on the tramways or omnibuses. The cost of materials had increased and the contract price of coal was nearly 80 per cent. higher than the price prior to the war. Owing to existing contracts, they had not much to complain of with regard to petrol, but for 1917 the cost of motor fuel would be considerably higher. It had been impossible to carry out their ordinary programme of renewals and reconstruction, and there was a decrease in the amount expended. More provision had been made for depreciation than in an ordinary year, as owing to the shortage of labour and the difficulty of obtaining spare parts it was impossible to maintain the motor vehicles at the usual standard. As a result of the year's business the company had earned a net revenue of £105,460, which enabled the board to recommend a dividend on the ordinary shares of 7 per cent. per annum, making 6 per cent. for the year as compared with 5 per cent. last year. The reserve fund was also strengthened by £30,000, and £9,636 had been carried forward. Over 1,500 men had joined the colours, representing 70 per cent. of the staff, excluding those engaged upon munitions. Weekly allowances had been continued to the dependants of the men on active service, and the amount so paid during the year was over £12,000, making the total amount so expended £29,000.

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FINANCIAL REPORTS AND MEETINGS.

Simplex Conduits Company.—A dividend of 10 per cent. and a bonus of 10 per cent., free of tax, has been declared.

The British Westinghouse Company have declared a dividend of 7½ per cent. actual on the preference shares for the past year.

Canadian General Electric Company have declared a quarterly dividend of 2 per cent. for the three months ended March 31.

The Mirrlees Watson Company announce a dividend of 10 per cent., less tax. In the previous year the distribution was 5 per cent.

Birmingham Small Arms Company, Ltd.—The directors have declared an interim dividend on the ordinary shares of 5 per cent., free of income tax.

Manila Electric Railroad and Lighting Corporation have declared a dividend on the common capital stock of 1½ per cent. for the quarter ended March 31.

The Brazilian Traction, Light, and Power Company.—The directors have declared a quarterly dividend of 1½ per cent. on the fully paid cumulative preference shares.

City of Carlisle Electric Tramways.—After meeting debenture interest in 1916 and appropriating £2,000 for redemption of second debentures, the balance of £658 brought forward was increased to £775.

British Insulated and Helsby Cables.—A final dividend of 10s. per share, making the interim dividend 15s. per share, has been declared, together with a bonus of 5 per cent., making in all 20 per cent. for the past year.

Great Orme Tramway.—The receipts for the year ended Dec. 31, 1916, amounted to £21,916, an increase of £297 over the receipts for 1915. The profit was £483, an increase of £389. The balance at the credit of the net revenue is £438.

W. T. Henley's Telegraph Works Company.—The directors recommend a final dividend on the ordinary shares of 10 per cent., less income-tax, making 15 per cent. for the year; also a bonus of 10s. per share, less income-tax. The rate is the same as a year ago.

Mersey Railway Company.—The accounts for 1916 show £21,299 available for debenture interest, compared with £21,442 for the previous twelve months, and, after providing for prior charges, 1 per cent. will be paid on the B debenture stock, leaving £21 to be carried forward.

Hong Kong Tramways Company have declared a dividend of 23 per cent. less income tax for the half-year, making 30 per cent. for the year. A sum of £2,441 has been written off capital cost, and £16,705 carried forward. Last year the dividend was at the rate of 12 per cent.

Bruce Peebles and Company.—The annual report shows that the profits amount to £24,468. After allowing for interest and depreciation there remains a net profit of £11,930, subject to excess profits duty and control taxation for the years 1915 and 1916, the amounts of which have not yet been ascertained. Last year the net profits amounted to £7,096.

Yorkshire (West Riding) Tramways.—At a special meeting, held on March 1, a resolution was passed giving wide powers to the directors to deal with the arrears of preference dividend, which amount to 43 per cent. It is understood that the course to be adopted will be the purchase of arrears from shareholders as the funds of the company permit.

Jarrow and District Electric Traction Company.—The revenue for 1916 amounted to £8,755, and after providing for working expenses and debenture interest, and adding £800 to the renewals fund, net profits were £2,213, while £1,039 was brought forward. A dividend of 3 per cent. is proposed on the ordinary shares, adding £900 to the reserve, and carrying forward £855.

Stewarts and Lloyds.—The directors recommend a dividend of 6 per cent. on the preference shares, 10 per cent. on the preferred ordinary shares, and 2s. on the deferred shares, together with a bonus of 6d. per share. A sum of £100,000 has been set aside for depreciation, £60,000 is placed to general reserve, £20,000 to employees' benefit reserve, and £110,000 is carried forward.

Paisley District Tramways.—The accounts for 1916 show a net revenue, including £3,478 brought forward, of £30,291. After writing down investments by £1,163, and placing £8,000 to general reserve, the directors recommend a further dividend of 2½ per cent. on the preference shares, making the full 5 per cent. for the year (the same as for each of the two preceding years), leaving £4,746 to be carried forward.

Hadfields, Limited.—The directors of Hadfields, Limited, Sheffield, recommend a further dividend of 4s. and a bonus of 1s. per share on ordinary shares, making 6s. per share (30 per cent.) for the past year. The Board propose to add £85,000 to the reserve and renewal account, and to carry forward £185,694. The ordinary shares received 25 per cent. for 1915, 22½ per cent. for 1914, and 20 per cent. for each of the years 1913 and 1912.

Bournemouth Corporation Tramways.—At a budget meeting of the Corporation it was stated the estimated income of the tramways for the year ending March 31 was £115,685, the gross balance £62,185, and the net balance £22,572. From the latter sum the following deductions would have to be made:—Allowance to dependents of men on service, £4,600; war bonus, £2,000; motor omnibus loan charges, £915; total, £7,515; leaving a net profit of £15,057.

Record Rate Relief at Wallasey.—In submitting the annual budget to the March meeting of Wallasey Corporation, the chairman of the Finance Committee stated that for 1915-16 the tramways contributed £8,500 to the relief of the rates. This year the Tramways Committee were able, after placing £4,000 to the reserve fund, as against £3,000 for the previous year, to allocate to the relief of the rates £11,000, which established a record. The Electricity Committee were unable to fulfil their anticipation of allotting £1,000 to the relief of the rates.

South Shields Corporation Tramways.—The estimated profit for the financial year ending on March 31, 1917, is approximately £5,554. Of this amount £3,102 has been invested in the War Loan, and the Tramways Committee have resolved that the balance of £2,452 be transferred to the general district rate. The net profit for the previous year was £6,504, when £2,400 was voted to the relief of the rates. For the second year in succession a decreased revenue from the electrical undertaking has made it impossible for that department to assist in reducing the rates, which have consequently been increased from 7s. to 7s. 8d.

Blackpool and Fleetwood Tramroad Company.—At the annual meeting, the chairman (Mr. J. Greenwood) stated that the receipts for 1916 were £42,982, an increase of £3,798. The outgoings came to £24,471, an increase of £4,622. These increased costs were due to a small extent to the increase in the work done, the company having carried 300,000 more passengers, but were mainly due to the increase of prices for everything. The greatest increase of all was taxation, which was £2,495 more. A dividend of 4½ per cent. (making 6½ for the year), with £1,000 put to the general reserve, was approved. The company have invested £21,000 in the new War Loan.

British Aluminium Company, Limited.—The directors recommend a final dividend at the rate of 12 per cent. per annum on the ordinary shares, making, with the interim dividend of 4 per cent., 10 per cent. per annum (as compared with 7 per cent. in 1915), leaving £26,926 to be carried forward. Including the amount brought forward, and after making provision for excess profits duty and limitation of profits under control, and debenture interest, there is an available balance of £239,962. The net profit appears to be £290,200, as compared with £130,000 in 1915. By the addition of £60,000 the depreciation fund is raised to £310,000, and £75,000 has been added to reserve, increasing that fund to £325,000.

Madras Electric Tramways.—The accounts for the year ended December 31, 1916, show a gross profit of £24,408. Deducting interest, London office expenses, provision for debenture stock sinking fund, and transferring £6,000 to depreciation and renewal account, there is a balance of £13,123. Adding £4,272 brought forward, there is an available balance of £17,396. The directors recommend a dividend of 6 per cent. on the preference shares and 8 per cent. on the ordinary shares, and an allocation to reserve of £2,500, leaving a sum of £4,315 to be carried forward. The traffic receipts show an increase of 8·3 per cent. upon 1915. Owing chiefly to increased prices of material and higher freights, the cost per mile has risen to 6·1 per cent. The undertaking has been maintained as usual out of revenue, and special improvements and renewals have been debited to the depreciation and renewals fund.

Para Electric Tramways and Lighting Company.—Mr. Follett Holt, presiding at the meeting, stated that the Brazilian exchange had been maintained throughout the year at about 12d. per milreis, and as a result of the increase in the volume of their business they were able to recommend a dividend of 6 per cent. on ordinary shares. This could only be considered a modest return, and they must wait for a return to the pre-war standard of exchange. The net revenue in milreis was the largest yet obtained. The combined gross earnings of the tramways and lighting departments had increased by 11 per cent., while the operating expenses were only 7 per cent. higher. The passengers numbered over twenty millions, or 13 per cent. more, while the sale of electricity had increased by 10 per cent. The company had striven to serve the public well, and the Para authorities had shown the company every possible consideration.

Pontypridd Council Tramways.—The income for the year ended March 31, 1916, amounted to £23,097 (13·28d. per car-mile), and the expenditure, in uding payment for energy at 1½d. per Board of Trade unit, to £16,209 (9·32d. per car-mile), leaving a balance of £6,888, which compares with £6,575 a year ago. After deducting charges for interest and contributions to sinking fund (£3,914), active service allowances, etc., the accounts show a loss of £1,803. Adding to this £292 on account of capital expenditure defrayed out of revenue during the year and a deficit balance brought forward from last year of £1,120, there is a total deficit of £3,215. Deducting from this the contribution from the district fund of £2,875, there is a deficit balance to be carried forward of £339. The energy consumed per car-mile was 1·5 units, as compared with 1·47 a year ago. The percentage of working expenses to total receipts was 72·48.

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Lancashire United Tramways Company.—The accounts for the year 1916 show a net profit of £33,105. The receipts increased £12,979. The increase in expenditure amounted to £8,775, due to the additional output of electrical energy and to increased charges for materials and labour. Interest and dividends received from the operating companies, together with sundry receipts, amounted to £16,782. After deducting interest on the prior lien debenture stock and expenses, there remains £3,024. Out of this interest will be paid on the second mortgage debenture stock for 1916 at the rate of 1 per cent., which will absorb £2,965, and £59 is carried to depreciation account. There is a balance on the year's working of the operating companies, after payment of the interest and dividends, of £17,580. Depreciation and renewal accounts and amounts carried forward in the combined companies now amount to £57,330.

Record Traffic on Liverpool Overhead Railway.—In moving the adoption of the annual report at the meeting of this electric railway company, Mr. H. C. Woodward said that in 1916 they carried 16,674,673 passengers (exclusive of season ticket holders), an increase of 1,592,141, thus creating a new record. The receipts (£105,526) did not represent the actual traffic, but remained when the surplus over their 1913 revenue had been paid to the Government. The expenditure amounted to £73,394, while miscellaneous receipts brought the net income to £34,456. After adding £4,000 to the renewal fund, and £400 to contingent fund, they would pay a final dividend of 2 per cent. on ordinary stock, making 3½ per cent. for the year, and carrying forward £6,801. Last year they carried 3½ million more passengers than in 1913, with about the same train mileage. They ran a three minutes' service in the busiest hours. The board had appealed against the increase of 50 per cent. in railway fares, but the reply was that no distinction could be made.

The Higher Fares on Leicester Corporation Tramways.—The report for the year ended December 31 last shows a total revenue of £216,270, an increase of £27,750. The passengers numbered 42,232,638, an increase of 1,792,480, and the cars ran 4,108,303 miles, an increase of 208,364. The total receipts averaged 12·634d. per mile, against 11·601d., an increase of 1·033d. per car-mile. There was an increase in passenger receipts of £16,278 owing to the exceptionally good trade in the town and to increased fares. Working expenses amounted to £152,954, an increase of £30,811. This was due to increased power consumption, war bonus to employees, and higher price of materials. The gross profits amounted to £63,317, to which must be added bank interest, £157, making a total of £63,474, against £66,733 the previous year. Interest, sinking fund, income-tax, and war allowance to employees in H.M. forces, etc., were £61,316, against £54,772, an increase of £6,544, leaving a net balance to the credit of appropriation account of £2,157. The 160 cars have been maintained as perfectly as possible under the adverse conditions.

Mansfield and District Tramways.—Presiding at the annual meeting, Mr. A. R. Holland said that the profit brought into the revenue account was slightly more than in the previous year. This result had been arrived at after making full provision for all charges in respect of maintenance of track, overhead lines, etc. The service had been fully maintained, and approximately 5,000,000 passengers had been carried during the year. The company's reserves had been materially strengthened by the appropriations made out of profits, and this had enabled the directors to write off the whole of the preliminary and formation expenses, leaving a balance of £9,000 at the credit of the reserve account. They had applied for £10,000 of the new War Loan. The directors recommended the payment of the half-year's dividend on preference shares to December 31 last, the payment of a final dividend of 4 per cent. on ordinary shares, making, with the interim dividend, 7 per cent. for the year, leaving a balance of £1,896. For 1915 seven per cent. was paid for the year, £2,500 being placed to reserves and £1,545 carried forward. Mr. A. R. Holland and Mr. C. R. Walker were re-elected directors.

Fife Tramways, Light and Power Company.—Mr. W. Low, chairman, in moving the adoption of the report of the several undertakings at the eighth annual meeting, said the Dunfermline and District Tramways showed some improvement during the year compared with 1915, the revenue paid over to the company by way of dividend and management fees being £15,000, an increase of £1,350. Keeping in view the trying conditions under which the Dunfermline and District Company was operating, the result was very satisfactory. The cars ran 638,620 miles, as compared with 634,500 miles, and carried 4,230,548 passengers, as compared with 3,924,983 passengers during 1915. Pending receipt of the Treasury consent to the issue of the capital, the company could not make any arrangements for dealing with the construction of the lines to Rosyth naval base. The Fife Electric Power Company's progress had been satisfactory. The increased revenue was due to the capital expenditure of past years producing additional business. The total revenue from power and lighting undertakings, as dividends, fees, etc., amounted to £14,671, an increase of £1,104. The directors recommended distribution on ordinary shares at the rate of 4½ per cent. per annum.

Preston Corporation Tramways.—For the year 1915-16 the total revenue was £51,332, or an increase of £3,557. The passengers increased from 10,761,381 to 11,631,232, whereas for 1914-15 the percentage of increase in the receipts was only 3·98, it was 7·44 for 1915-16, compared with an average of about 6·40 for the period 1911 to 1914. The average number of passengers per car-mile was 10·59, compared with 9·88. The working expenses and war service allowances totalled £31,201, and the gross profit was £20,130. After the standing charges had been deducted, amounting to £16,433, there was a abalance to be carried forward of £3,697. The reserve fund has been increased from £42,596 to £47,309, by interest on amount utilised for capital purposes (£1,000), bank interest (£411), and the value of materials on hand (£3,221). In his report, Mr. J. F. Simpson, the general manager, states that the increase of £201 in the working expenses was due principally to the increased cost of fuel, and that the great advance in the cost of other materials had not seriously affected the expenditure, owing to the large stock of material purchased at comparatively low prices immediately after the outbreak of war. One hundred and thirteen employees, equal to 45 per cent. of the normal staff, joined the forces, and the sum of £1,197 was paid to their wives and dependents. The receipts on one route increased by 19·47 per cent., presumably on account of the soldier traffic.

Gateshead and District Tramways Company.—The directors' report and statement of accounts for the year ended December 31, 1916, states that the revenue for the year amounted to £77,333. After deducting all expenses chargeable to revenue, including provision for renewals £3,000, there remains a balance of £35,136. To this amount is to be added £4,239 brought forward, making £39,376. The directors recommend the appropriation shown in the accounts, viz. :—To special reserve, £7,500 ; to reserve, £5,500 ; to sinking fund for redemption of mortgages, £2,539 ; to dividend for the year on £12,610 six per cent. preference shares, £756 ; to dividend for the year on £120,000 five per cent. preference shares, £6,000 ; to dividend on ordinary shares at the rate of 12s. per share, £8,100 ; to bonus of 8s. per share on ordinary shares, £5,400 ; to be carried forward £3,579, making £39,376. They recommend the transfer of £7,500 to special reserve, making a total of £17,500 placed to that account. The amount of £6,239 has been charged to the account, being excess profits duty for the years 1914 and 1915. The expenditure chargeable to capital account amounted to £407, making the entire capital outlay of the company in and upon the tramway undertaking £339,094. At the annual meeting on March 22, Mr. H. S. Day (chairman) said the receipts showed an increase of £4,432 and the expenditure an increase of £4,745 after making a provision of £3,000 for renewals, leaving a decrease of £313 in the working profit. The increase in expenses was made up chiefly of higher wages, the increased cost of materials, and the higher income-tax. The undertaking was in a strong financial position. The report was adopted, and £750 was voted to the directors as remuneration. Mr. G. I. Somerville was elected a director.

The Fares on the Underground Electric Railways of London.—In moving the adoption of the report at the annual meeting of the Underground Electric Railways Company of London, Lord George Hamilton said that the traffic results for the five companies in whose securities they were interested amounted to £6,038,529, an increase of £557,385, or over 10 per cent. The " revenue liabilities " of these companies, which included working expenses, interest charges, and provision for depreciation and reserves, amounted to £5,531,561, an increase of £501,783—slightly under 10 per cent. The sum retained for depreciation and reserve by the railway companies was increased by £45,000. The total surplus of the operating companies, after paying working expenses and all prior charges, including preference dividends, but before making reserves, had increased by £100,184. The less satisfactory feature had been the accelerated rate of increase in working expenses. Owing to the scarcity of material and labour the maintenance of the various properties, while sufficient for safe and regular operation, had not been up to the usual standard. These facts induced the railway companies to increase their reserves rather than further increase dividends. The total income of the Underground Electric Railways Company was £653,361, a decrease of £27,380. This reduction was practically equal to the reduction in the dividend of the Associated Equipment Company, the return from the transportation companies being in the aggregate nearly the same as last year. This income permitted the payment of all fixed and cumulative charges and 5 per cent., free of tax, for the year on the 6 per cent. income bonds. The greatest obstacle to the increased prosperity of the operating companies was increased cost of everything they required, and the recent Order restricting poster advertising was likely to result in a considerable loss. These matters would probably compel the directors to consider a readjustment in fares.

Post Office Wires and Tramway Wires.—The Tramways and Light Railways Association have informed the Postmaster-General that they regret his action in declaring a variation in the charges for the installation of insulated wire in place of bare guard wire at tramway crossings. In reply, the Postmaster-General has stated that the cost and propriety of the relative charges will be examined from time to time. The Municipal Tramways Association have notified the Postmaster-General that they have recommended their members to pay the revised charges.

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CONTRACTS AND ORDERS.

Hadfields, Limited, of Sheffield, have an order for supplying 60 tramcar wheel tires to the Erith Council Tramways.

St. Helens Electricity Committee have accepted a tender from Babcock and Wilcox, Limited, for two new boilers.

Leyton Council have accepted the tender of the British Insulated and Helsby Cables, Limited, for trolley wire.

Cheltenham Council have placed an order for an Orwell electric lorry with Ransomes, Sims and Jefferies, Limited, at £924.

E. Green and Son, Limited, are to supply and erect new economisers for the St. Marylebone electric supply department.

Glasgow Tramways Committee have accepted the tender of the Liverpool Electric Cable Company for the supply of cable.

Salford Council have ordered from the British Westinghouse Company a 1,250-KW. rotary converter set for the electricity works.

The British Thomson-Houston Company's tender for three 1,000-KW. rotary converters at £3,160 has been accepted by Glasgow Town Council.

Loughborough Council have placed an order with Messrs. Babcock and Wilcox, Limited, for a boiler at £2,600, and an underfeed stoker at £574.

London County Council have purchased two additional grinding machines for the central car repair depot of their tramways undertaking at a cost of about £400.

Derby Council have accepted the tender of E. Morley and Sons for power station extensions at £12,150, and of J. A. Aiton, Limited, for the supply of steam piping.

Wolverhampton Council have been recommended to accept the tender of Coop and Company, Limited, Wigan, for 12 months' supply of uniforms for tramway inspectors, motormen, and conductors.

The Mirrlees Watson Company, Limited, Glasgow, have recently received orders for 69 sets of condensers, practically all for war service work, aggregating approximately 1,400,000 lbs. steam duty per hour.

Bradford Tramways Committee have accepted the following tenders :—Supply of 100 tons of cast-iron brake blocks, National Rail and Tramway Appliances Company, Limited ; making-up cloth into women's uniforms, H. Woodhead, Bradford.

The United Electric Car Company have an order from Huddersfield Corporation Tramways for cars. The Ministry of Munitions having declined to give a certificate " A " for the purchase of new cars, it has been decided to order the cars under class " C " certificate.

Manchester Electricity Committee have accepted the subjoined tenders :—500-KW. motor converter, Bruce, Peebles and Company, Limited ; cable, British Insulated and Helsby Cables, Limited, W. T. Glover and Company, Limited, Pirelli General Cable Works, Limited, Callender's Cable and Construction Company, Limited.

Bedford Council have adopted the following tenders :—Siemens Brothers and Company, Limited, cables, £3,273 ; laying and jointing the cables, £2,631 ; British Electric Transformer Company, Limited, transformers, £1,136 ; Stirling Boiler Company, Limited, two boilers and mechanical stokers, £6,610 ; British Thomson-Houston Company, Limited, turbo-generator and condensing plant, £8,674.

White Motors and Accessories, Limited, of Concannon Works, Concannon Road, Brixton, S.W., have recently received orders for jacks from the following tramways :—Aberdare Urban District Council Tramways ; Bristol Tramways and Carriage Company, Limited ; Coventry Corporation Tramways ; Newport (Mon.) Electricity and Tramways Department ; and Sheffield Corporation Tramways and Motors.

Manchester Tramways Committee have placed contracts as subjoined :—Automatic point controllers, Forest City Electrical Services Supply Company, Limited, Salford ; special trackwork, Hadfields, Limited, Sheffield ; materials and stores, British Thomson-Houston Company, Limited, Dick, Kerr and Company, Limited, British Westinghouse Electric and Manufacturing Company, Limited, P. R. Jackson and Company, Equipment and Engineering Company, Limited, Drake and Gorham, Limited, General Electric Company, Limited, British Insulated and Helsby Cables, Limited, Britannia Lamps and Accessories Company, Limited, Ferranti, Limited.

Salford Tramways Committee have accepted tenders for stores among which are the following :—Car accessories, electrical, British Westinghouse Company, Manchester Armature Repair Company, L. Andrews and Company, Western Electric Company, Ward and Goldstone, British Insulated and Helsby Cables ; car accessories, Tandem Smelting Company, British Westinghouse Company, Hadfields, Limited, National Rail and Tramway Appliances, Limited, Brown Bayley's Steel Works, G. W. Allsop and Company, Anti-Attrition Metal Company ; special car accessories, British Westinghouse Company ; ears, frogs, etc., British Insulated and Helsby Cables, Britannia Lamp and Accessories Company.

PERSONAL.

Mr. C. A. Frost has been appointed borough electrical engineer of Bexhill, at a salary of £300 per annum.

Mr. B. C. Wilson has been appointed manager and engineer of the La Plata station of the River Plate Electricity Company.

Mr. A. T. Lambert, general manager and electrical engineer, Maidstone Corporation Tramways, has been voted an increase in salary.

Councillor Richard Holt has been appointed chairman of the Blackpool Electricity Committee in succession to the late Alderman J. Brodie.

Halifax Corporation have granted the following increases of salaries :—Tramways traffic manager, from £400 to £425 ; the tramways engineer from £300 to £325.

Alderman F. A. Dunsford, who was re-elected chairman of the Southampton Corporation Tramways Committee in November, is occupying that position for the eighteenth consecutive year.

Mr. J. W. Clunas has resigned the post of city electrical engineer at Cape Town consequent upon receiving the offer of an appointment with Messrs. Rennert and Lenz, of Johannesburg.

Mr. F. H. Rudd, station superintendent, Rochdale Corporation Electricity undertaking, has been appointed acting engineer for a period of three months, after having been in charge during the illness of Mr. Atchison.

Mr. G. H. Swingler has been recommended by the General Purposes Committee of Cape Town Corporation for appointment as acting electrical engineer. The appointment will be for six months at a salary of £750 per annum.

Mr. J. N. Bailey, chief of the turbine department of the British Westinghouse Electric and Manufacturing Company, is travelling in Australia primarily for reasons of health. He expects to visit the principal power plants.

Mr. Spark, acting general manager, West Hartlepool Corporation Tramways, during the absence with the army of Mr. C. Burgess, the general manager and engineer, has been voted £105 for his services during the past seventeen months.

Mr. E. V. Hiley, who last year resigned the town clerkship of Birmingham to join the directorate of the Metropolitan Carriage and Wagon Company, is acting as chief of the staff of Mr. N. Chamberlain, Director-General of National Service.

Mr. A. Chapman, of Exeter, has been appointed depot foreman of West Hartlepool Corporation Tramways. Before the appointment was made a deputation of two visited Preston, Portsmouth, Exeter, and Swindon to gather information and see the work of the several applicants.

Mr. J. K. Bruce, deputy chief officer of the London County Council, has been appointed traffic manager as from April 1, at a commencing salary of £1,250 per year, rising to £1,500. Under the reorganisation scheme, upon his transfer the position of deputy chief officer has been abolished.

Mr. E. Carden, general manager, Dover Corporation Tramways, in reporting on the shortage of staff, stated that he and the inspectors had had to drive cars, and that the traffic had increased 50 per cent. The work had been very trying to him and he had felt that he must ask the committee for a short rest.

Mr. Archibald Page has been appointed assistant general manager of the Clyde Valley Electric Power Company. For twelve years he has been deputy chief engineer of the Glasgow Corporation electricity department. During that period the Glasgow undertaking has increased its output from 3,000,000 to 132,000,000 units per annum.

Mr. H. F. Clayton, chairman of Clayton and Company, Huddersfield, Limited, Karrier Works, Huddersfield, has given the use of his private residence, Craigmohr, Huddersfield, for the duration of the war to the Commandant of the Huddersfield War Hospital. The authorities are using Mr. Clayton's house as a nurses' home.

Mr. A. S. King, of 28, Victoria Street, Westminster, has been appointed representative of the General Vehicle Company, Limited. Mr. King has for many years represented the United Electric Car Company, but owing to rearrangements incident to the purchase of that company by Dick, Kerr and Company, Limited, he recently resigned.

Mr. C. C. Atchison, late electrical engineer to Rochdale Corporation, and formerly tramway manager also, has been presented with gifts from the officials of the Corporation, from over forty pre-war members of the electricity staff, and from the local branch of the Municipal Officers' Association. Mr. Atchison recently resigned his appointment owing to ill-health.

Mr. E. J. Neachell, general manager, Liverpool Overhead Electric Railway, his assistants, and the employees were congratulated at the annual meeting by Mr. H. C. Woodward, the chairman, on the successful manner in which they had carried on the undertaking, despite the difficulties entailed by the reduced staff, comprising many new hands, and a traffic that had increased by about 26 per cent.

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Sir William Mather in a letter resigning the chairmanship of Mather and Platt, Limited, read at a shareholders' meeting, said that after the war would dawn a new era in the relations between employers and employees. One of the most hopeful signs was a closer union between engineering firms who were competitors. This better understanding would help the country to organise against foreign competition.

Highways Committee of the London County Council.—At the first meeting of the Council for the year 1917-18, held on March 20, the following members were appointed to the Highways Committee, which has the administration of the tramways, for the ensuing year:—G. H. Hume (chairman), A. H. Scott (vice-chairman), Sir John Benn; Messrs. D. Davies, W. H. P. Gibson, G. M. Gillett, A. O. Goodrich, F. C. Harrison, W. Haydon, D. Hazel, W. Hunt, Jas. Little, H. Marks, W. A. Nicholls, H. Ward, and A. W. Yeo.

Professor W. Ripper, Principal of the Applied Science Department of Sheffield University, has been elected Vice-Chancellor. The vacancy has arisen through the appointment of Mr. H. A. L. Fisher as President of the Board of Education. **Mr. Douglas Vickers,** a director of Vickers, Limited, has been appointed treasurer, in succession to the late Colonel Hughes. It has been decided to divide the faculty of applied science into separate faculties of engineering and metallurgy.

Sir Albert Stanley, in consequence of his appointment as President of the Board of Trade, has resigned the position of managing director of the companies forming the London Underground group, including the General Omnibus Company. In his place **Mr. C. W. Burton** will act as managing director of these companies, which include the Underground Electric Railway Company of London, Limited, the Metropolitan District Railway, the London Electric Railway Company, the Central London Railway, and the City and South London Railway.

London County Council Tramways Appointments.—In accordance with the reorganisation scheme adopted for the tramways department, the London County Council have advertised for applications for the positions of electrical engineer, operation superintendent in the traffic branch, and development superintendent in the traffic branch. The maximum age limit is 50 years. For the first and second appointments applications had to be received on April 23, and for the third appointment the date fixed is May 7, not later than 1 p.m.

Mr. Chas. Challenger, manager of the Bristol Tramways and Carriage Company, and the staff generally received a tribute of thanks at the recent annual meeting. It was voiced by Mr. Samuel White, the chairman, who, in responding to a vote of thanks, said he could not take personal credit for the satisfactory conditions of which he had spoken in moving the adoption of the report. The credit must be given to his colleagues, to the managing director, Mr. W. G. Verdon Smith, the manager, the heads of departments, and the staff.

Leeds Officials' Salaries.—At the meeting of the Corporation on March 7 a large number of officials were recommended for increases in their salaries, including the following:—The chief constable, £800 to £1,000; Mr. G. E. Watmough, tramways works and depot superintendent, £300 to £325; Mr. J. Blakeborough, tramways accountant, £250 to £275; Mr. J. Buckley, tramways highways and permanent way superintendent, £250 to £275; Mr. W. T. Green, assistant electricity manager, £450 to £475; Mr. W. Ainscough, electricity mains and sub-station engineer, £250 to £275. The recommendations were adopted.

Sir Maurice Fitzmaurice, C.M.G., has been appointed chairman of the committee to control the canal system which has been taken over by the State for the duration of the war. Sir Maurice was for many years engineer to the London County Council, including the period of the electrification of the tramways and the construction of additional lines. He was one of a distinguished company of guests at the Irish Club at the dinner held last month on St. Patrick's Day, on which occasion Lord Northcliffe urged that great prosperity would accrue to Ireland by the use of water power for the generation of electrical energy for industrial purposes. We may add that some years ago Mr. Healy carried a Bill through the House of Commons to effect that object, but the measure was rejected by the House of Lords. The suggestion has been made that Lord Northcliffe should reintroduce the Bill in the Upper House.

Mr. G. Blackburn and Mr. J. W. Hewitt, who are respectively rolling stock superintendent and cashier to the Manchester Corporation Tramways, were on March 28 granted increases in their salaries, Mr. Blackburn from £350 to £400, and Mr. Hewitt from £265 to £300. The Electricity Committee advised that an agreement be entered into with Mr. H. C. Lamb, resident engineer at Stuart Street generating station, that his salary be £500 for the first year, £550 for the second, and £600 for the third year. The same committee proposed that the following increases be given to other officials:—Mr. T. Baxendale, assistant resident and constructional engineer, from £300 to £350; Mr. J. R. Davidson, boiler house engineer, £225 to £275; Mr. H. W. Smythe, engineer-in-charge, £225 to £245. A Labour councillor proposed that the increases should be deferred until after the war, but the Corporation adopted the list almost without discussion. Alderman Bowes, chairman of the Tramways Committee, remarked that that committee asked for advances amounting to only £168 on a wages list of £100,000 per annum.

The death of **Mr. J. W. Nuttall,** cash clerk to the Sheffield Corporation Tramways, is announced. He had been for twenty years in the employment of the Council.

Mr. R. G. Sharpe, general manager of the Leeds Forge Company, has died at his residence after a short illness. Mr. Sharpe became works manager for the company 13 years ago, and in 1910 he was appointed general manager. He was formerly with the Great North of Scotland and Midland Railway Companies.

Mr. J. C. Midgley, acting city surveyor of Newcastle-on-Tyne, has died after a short illness. He was appointed to the position early in the present year upon the Corporation granting permission to Mr. W. J. Steele, the city engineer and tramway permanent way engineer, to join the roadmaking battalion for service in France.

Mr. A. E. White, late city engineer of Hull, has, we regret to state, died at Bournemouth after a long illness. Mr. White, who was 61 years of age, was for 21 years the city engineer of Hull, retiring in October, 1914. Among the enterprises which he carried out was the electrification of the tramways. He adopted the centre groove rail laid on longitudinal sleepers. There is no doubt that a large saving in maintenance was secured by the excellent way in which the work was designed and carried out.

The Late Sir George White.—The directors of the Bristol Tramways and Carriage Company, in their report for the past year, record with the deepest regret the death on November 22 last of the chairman, Sir George White, who had been identified with the company since its inception in 1874, filling in succession the positions of secretary, managing director, and, for the last 17 years, chairman. His services and untiring energy had been devoted to the interests of the company for the long period of 42 years, and it was due to his foresight that the company had been a pioneer in the introduction of electric traction in the United Kingdom and later of motor traction for commercial purposes. By his death the directors, the staff, and the shareholders have suffered an irreparable loss.

Mr. J. S. Raworth, who died on March 24, at the age of 71, was a pioneer of electricity supply and electric traction. His death will be widely regretted, not only on account of his services to the industry, but especially because of his engaging personality. This was shown by the representative attendance at the funeral on March 28 at Streatham, S.W. From 1880 to 1886 Mr. Raworth was with the Siemens Company at Woolwich, for whom he carried out electrical installations on steamships. In 1886 he became identified with the Brush Electrical Engineering Company, the association continuing for many years. He was elected a director of the British Electric Traction (Pioneer) Company in 1895, and subsequently became managing and technical director of the present company, which succeeded the pioneer company. From that position failing health caused him to retire in 1914, retaining connection with the company as consultant.

RAILWAY OFFICERS AND STAFF.

Mr. John H. Follows has been appointed acting general superintendent of the Midland Railway Company during the absence of the general superintendent.

Mr. Buckmaster, of the general manager's office, London and South Western Railway, has devised a season ticket in the form of a disc, very little larger than half-a-crown, which can be fitted into a metal case to be worn by the ticket owner.

Mr. S. H. Hunt has been released by the London and North Western Railway Company to act jointly with Sir Richard Redmayne as assistant to Mr. Calthrop, the Controller of Coal Mines. Mr. Hunt is commercial assistant to the general manager of the London and North Western Railway.

Mr. J. B. Ball, the engineer-in-chief of the Great Central Railway, has been appointed chief engineer of the London, Brighton and South Coast Railway in place of Mr. C. L. Morgan, who has relinquished the post on his appointment as a director of the company. Mr. Ball joined the Great Northern Railway in 1890.

Captain C. L. Conacher, formerly traffic manager of the Cambrian Railways Company, has been appointed an assistant director at the Ministry of Munitions. Captain Conacher entered the Ministry of Munitions when first formed in May, 1915, after nine months' previous service as a railway transport officer on the War Office staff.

Sir Robert Turnbull is acting as general manager of the London and North Western Railway during Mr. Guy Calthrop's employment as Controller of Mines. Sir Robert, who entered the company's service in 1868, acted for more than twenty years as its superintendent, and was offered the post of general manager in succession to Sir Frank Ree.

Mr. I. T. Williams, chief goods manager, London and North Western Railway, has been appointed as acting general manager in the absence of Mr. Guy Calthrop. Mr. Williams is chairman this

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year of the goods managers' conference and the goods managers' executive committee. He has also been elected to serve on the executive committee for the Government control of canals.

Mr. Guy Calthrop's appointment at the head of the Board of Trade Committee which has taken over the coal mines of the country for the duration of the war was referred to at the annual meeting of the London and North Western Railway, of which he is general manager. Sir Gilbert Claughton, the chairman, observed that he was sure Mr. Calthrop would fill his temporary position as Controller of Mines with distinction. During Mr. Calthrop's absence Sir Robert Turnbull had consented to represent the company on the Railway Executive Committee.

WITH THE FORCES.

Mr. R. H. Spurling, formerly general manager of the British Columbia Electric Railway Company, has been granted a commission.

Acting Staff-Sergeant J. W. Clayton, formerly a motorman of the Burnley Corporation Tramways, has been awarded the Meritorious Service Medal.

Gunner Bass, formerly a motorman on the Dover Tramways, has been awarded the Military Medal for his services with an anti-aircraft gun section in France.

Company Sergeant-Major H. Keatley, who has been awarded the Military Medal for gallantry in France, was a reservist in the employ of Sheffield Corporation Tramways.

Sergeant J. Wright, R.E., who has been awarded the Military Medal, was mentioned in a despatch from Sir Douglas Haig. He was for fourteen years at Blackburn Corporation electricity works.

Private G. Cormack, who was formerly employed as a motorman by the Aberdeen Suburban Tramways Company, has received an intimation that a distinction is to be conferred upon him for conspicuous gallantry in the field.

Mr. J. G. Beharrell, assistant goods manager, North Eastern Railway, Assistant Director-General of Transportation in France, and Assistant Director-General of Military Railways in England, has been gazetted lieutenant-colonel.

Sergeant J. E. Wolstencroft, formerly conductor on Hull Corporation Tramways, who has been in the K.O.Y.L.I. since September, 1914, has been recommended for a commission, and is now in an Officers' Training Corps. He joined the old Volunteer Force in Hull at the age of 16.

Captain G. C. Milnes, King's Own Royal Lancaster Regiment, borough electrical engineer for Lancaster, who has been on service since the outbreak of war with the machine gun section of his battalion, has been promoted to the rank of major. He has been mentioned in despatches.

Corporal W. Smith, formerly an employee of West Ham Corporation Tramways, has been awarded the Military Medal for gallant conduct. On the motion of Councillor Kensett, chairman of the Tramways Committee, the Council have forwarded a letter of congratulation to the corporal.

Private H. Pixton, who has died from pneumonia in a military camp in Wales, was an inspector on the Blackpool Corporation Tramways. He was 44 years of age, and enlisted in November, 1914.

Lieutenant T. J. Owen, who has died of wounds on active service, was the son of Mr. J. Owen, one of the directors of the Great Orme Tramway Company. At the annual meeting of the company the shareholders passed a vote of condolence with Mr. Owen.

TRAMWAY AND LIGHT RAILWAY NOTES.

BELFAST.

AN ERA OF IMPROVEMENTS.—GENERATING STATION DEVELOPMENTS.

At the March meeting of the Corporation, Councillor Alexander expressed gratification that the tramways manager was studying the comfort and convenience of passengers. By an ingenious raising of the brass rail between the seats and glass on the top deck of the cars an additional seating space of five inches was provided. Alderman Tyrrell, chairman of the Tramways Committee, said the manager was much concerned in introducing innovations, of which more would be heard later on. Since the Corporation's meeting we note that the Tramways and Electricity Committee have appointed two sub-committees, one to deal with tramway matters, including the permanent way, and the other with matters relating to the electricity undertaking. The city surveyor is relaying the track over the Queen's Bridge immediately after the beginning of the financial year. The sub-committee appointed by the Corporation to confer with Sir John Snell with reference to the electricity station, have reported that he will forward his report at an early date. In the meantime the committee have given, with his approval, a synopsis of his views. He advises alterations with a view to providing some margin of output in the plant in operation, and with plant in reserve to the amount of 3,400 KW. Sir John Snell does not approve of extension in the present station, subject as it is to the great difficulty of circulating water and the additional expense of coal delivery. He is of opinion that the committee should proceed to complete plans for the future development, and begin by obtaining expert assistance in choosing the sites for the sub-stations. They should also complete the plans and specifications of all buildings and machinery required for sub-stations and for the first instalment of the new station at Hamilton Road, in order to be ready to place contracts after the conclusion of the war.

BIRMINGHAM.

BOY SCOUTS ASSIST WOMEN CONDUCTORS.

Early in March eight Boy Scouts agreed to assist the women conductors on the Edmund Street tramway, Mr. McDonnell, traffic superintendent of the Corporation tramways, supervising the work as an experiment. Each boy took charge of the bell of a car from 5.30 p.m. to 7.30 p.m., and called out the names of the stopping-places. When the conductor had collected the fares the lad returned to the terminus and boarded another full car. The scheme has proved so successful that the general manager has invited Boy Scouts from other districts of the city to render similar assistance. The Tramways Committee allow the lads ration money to the amount of sixpence for the short time during which they are rendering this "good turn."

BLACKBURN.

EIGHTEENTH ANNIVERSARY OF ELECTRIFICATION.

The Corporation electric tramways attained their eighteenth anniversary on March 20, and about the same time the increased fares and revised stages necessitated by war conditions were brought into operation. Although for the time being the number of passengers has decreased, the receipts are higher to the extent sometimes of £100 per week.

BLACKPOOL.

A NEW ROUTE AND INCREASED FACILITIES.

On July 26 next, when the Lytham and St. Annes Tramways Company's lease of the Promenade, Lytham Road, and Central Drive route expires, the Blackpool Corporation cars will run on those sections. The company are to be allowed to continue to run over the Squire's Gate section, to the Central Station, and to Manchester Square, but this will also be made use of continuously by the Corporation. The new arrangement will enable the Corporation cars to run through from North Shore to Squire's Gate, and from there to the Central Station. Passengers will be able to travel for 3d. from North Shore, on the northern boundary of the borough, to Squire's Gate, on the southern boundary, and no extra charge will be made even in the holiday season. When Councillor Holt, chairman of the Tramways Committee, announced these details at a meeting of the Council on March 6, an effort was made to render season tickets available for the new route and up to Manchester Square for the present charge of £3 per annum, but the Corporation decided that an additional ticket at £3 must be purchased.

BRISTOL.

THE CORPORATION AND TRAMWAYS PURCHASE.—A YEAR OF INNOVATIONS.—SUNDAY MORNING CARS.

The chairman of the Tramways and Carriage Company informed the shareholders at the annual meeting that no further development had taken place during the year with regard to the Bristol Corporation's option to purchase the company's undertaking, except that the Corporation obtained an Order from the Board of Trade extending to October 31, 1917, the time within which their option must be exercised, if at all. The whole question appeared at present to be in abeyance. This was a matter which the shareholders should not regard with too great apprehension of ill results to the company. He was satisfied that whatever the future had in store this was not a subject upon which the shareholders should give themselves undue anxiety. As would be realised, the past year had been one of great difficulty, almost very day some new situation arising to require new methods and new plans. The difficulties had been met by the officials and staff in the most loyal spirit, and without their hearty co-operation the successful results of the past year could not have been achieved. Sanction has been given by the Watch Committee to the running of tramcars on Sunday morning to factories where work of national importance is carried on. Ordinary passengers will not be carried.

EDINBURGH.

FUTURE OF THE COMPANY'S STAFF—SCHEME FOR TRAMWAYS TO THE NAVAL BASE.

The Tramways Committee have delayed the question of considering whether the officers and employees of the tramways company should be taken over on the expiry of the lease until the completion of the agreement with the company for the purchase of the cars. In reply to a request from the Tramways Committee, to be informed of the Admiralty's opinion of a proposal to extend the tramways to Queensferry, the Admiralty have stated that while they recognised the advantages that would result from improved transport facilities to Rosyth, it was inexpedient that the scheme should proceed at the present time. The committee have replied, suggesting that the proposal might be submitted to the Reconstruction Committee of the Government which is giving attention to the provision of after-war work.

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GLASGOW.

ART UNION DRAWINGS FOR PATRIOTIC FUNDS—WAR WORK AND TRAMWAY RECEIPTS.

A great work for army recruiting and for the support of patriotic funds has been carried out by the tramways department from the beginning of the war. The latest method adopted by the general manager, Mr. J. Dalrymple, for assisting the patriotic funds is a weekly draw, on the Art Union principle, for pictures presented by artists. Penny tickets are sold by the conductors of the cars. Since the inauguration of the scheme in February the drawings have brought in weekly sums ranging from £1,000 to nearly £1,500. The increased activity of the city on war work is shown by the tramway receipts, which on March 25 reached over £1,000,000. The financial year began on June 1, 1916, and in the year 1915-16 it was April 16 before that total was attained.

HULL.

SEPARATE POWER-STATION TO BE DISCONTINUED.

At a meeting of the Electricity Committee, Councillor J. Pybus (chairman) outlined a scheme for effecting economy by a gradual disuse of the tramways power-station at Osborne Street, the tramways load to be supplied from the Sculcoates Lane station. A 5,000-K.W. turbo-alternator is about to be installed at the latter place, increasing the machinery by 8,000 H.P. Energy will be supplied at 6,000 volts by a cable to be laid to Osborne Street, where two rotary converters will reduce the voltage to 500. Councillor W. Wheatley, chairman of the Tramways Committee, and Mr. J. Wilkinson, electrical engineer, attended the meeting and supported the scheme. Mr. Wilkinson observed that about 25 per cent. of the Osborne Street plant was old, and something would have to be done at an early date, either by putting down fresh plant or taking energy from Sculcoates Lane.

KEIGHLEY.

SCHEME FOR A LINK WITH BINGLEY AND BRADFORD.

As the result of a conference between representatives of Keighley Rural Council and Keighley Tramways Committee, a report is to be presented to the Rural Council favouring an extension of the Keighley tramways from Stockbridge to the Bingley terminus at Crossflats, a distance of two miles. The Bingley tramways are worked by Bradford Corporation, who are to be approached with regard to through running. The scheme has been approved by Bingley Council, and the several authorities hope to obtain powers so that the work can be undertaken as a measure for providing employment after the war. It will entail the erection of a new bridge at Stockbridge by the County Council.

LIVERPOOL.

BELT ROUTE TO RELIEVE OVERCROWDING.

On March 15 an experimental service on a new belt route between Old Haymarket and Green Lane was inaugurated. The object was to afford a better service on the congested portions of the Old Swan-Knotty Ash and Green Lane-West Derby routes, thereby obviating overcrowding of the cars. Councillor Russell Taylor, presiding at a Tramways Committee meeting, appealed to the public to use the new route in order to relieve the congestion at the Landing Stage. Anyone wishing to get to the Old Swan district, instead of walking to the Pierhead, could, he said, just as readily find a car at the Old Haymarket. Previous experiments with circular routes have proved unsuccessful, owing to passengers, whose business or residence was in the immediate locality, preferring to travel by the long-distance cars, which thereby became overcrowded. There are indications that the present experiment is proving successful, and the tramways department are proposing to inaugurate three other circular routes.

LONDON.

USED TICKETS.—EXTRA POWER AND TRACK DOUBLING AT WOOLWICH.—BASIS OF PROVISION FOR RENEWALS.—TRANSFER TICKETS.

Mr. J. D. Gilbert, M.P., asked the chairman of the Highways Committee, at a meeting of the London County Council, whether, in view of the Government regulations for saving paper, some system could be devised for collecting used car tickets. Mr. G. H. Hume replied that up to 1911 boxes were placed on the cars for the reception of used tickets, but the results did not seem satisfactory. On two routes only 6 and 10 per cent. were collected. Upon Mr. Hume's reply, we may observe that several large tramway undertakings secure a valuable return from the sale of used tickets. The matter is one in which passengers require to be educated, and if paper and ink were available for the purpose, such an effort would be of great utility at this period. The police are credited with having caused the boxes to be removed from the County Council's cars, but used ticket receptacles have been placed during the past year or so on the Croydon cars, being fixed below the platform window. In view of the pressure of the Ministry of Munitions for the doubling of the tramways in Plumstead Road, the Woolwich Council have accepted the offer of the County Council to contribute half the estimated cost of the road widening, which is to be completed within three years of the end of the war. The line will, however, be doubled immediately. The Borough Council stipulate that the Ministry should contribute the balance of the cost of the road widening above the Council's contribution of one-third. The County Council have invited selected firms to tender for supplying cables and switch gear in connection with the provision of additional tramways power to the Woolwich district. The estimated cost of the extension is £30,000. On June 15, 1915, the Council decided that for a period of two years any surplus that might be available in respect to the working of the tramways should be paid into the renewals fund, and that the basis of the provision in respect of the renewal of certain portions of the tramways should be reconsidered at the end of that period. At their meeting of March 19 they decided that in the present circumstances no useful purpose would be served in attempting to settle the question, and the consideration of the matter was postponed for two years. The increased issue of transfer tickets on long distances during the past few years has proved beneficial both to the County Council tramways and to the public, who are encouraged to "Don't wait, but take a transfer." It is stated that passengers between Camden Road and King's Cross, and between Highbury and Highgate, are now to be given transfer tickets for a fare of one penny, instead of having to take two tickets on two cars at a cost of three-halfpence.

MIDDLESBROUGH.

PROPOSED PURCHASE OF TEESSIDE TRAMWAYS.

The General Purposes Committee of Middlesbrough Corporation have agreed to recommend the Council that it is desirable in the interest of the inhabitants of the town and district that the undertaking of the Middlesbrough, Stockton, and Thornaby Tramways Company should from 1918 be owned and worked municipally, provided that a satisfactory scheme can be agreed upon by the Corporations concerned, and that the conditions and outlook are then such as warrant their undertaking the necessary financial responsibility.

ROTHERHAM.

PURCHASE OF CARS FROM LONDON COUNTY COUNCIL.—AIR BRAKES.

Rotherham Corporation have agreed to purchase ten tramcars from the London County Council for £5,000. A similar agreement was recently concluded between the Sheffield Corporation and the London authority in consequence of the shortage of motormen in the Metropolis and the impossibility of obtaining cars from makers, whose works are controlled by the Ministry of Munitions. The single-deck cars which some time ago were purchased from Oldham Corporation were fitted with air brakes. As the vehicles are worked on flat routes the air brakes have been taken off.

PATENT LIST.

Abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

***** If the inventions have been communicated the names of the communicators are given below in italics.**

APPLICATIONS FOR LETTERS PATENT.

Driving gear for motor cars (3,013)—L. E. Dowsett.
Supports for solid band tires (3,154)—B. Lee and S. H. Lee.
Power transmission mechanism for motor vehicles (2,905)—T. H. Millington.
Regenerative braking systems (2,869 and 2,872)—T. H. Thomas and W. V. Turner.
Fluid-pressure braking apparatus (2,870 and 2,871)—W. V. Turner.
Attachment for wheels of self-propelled vehicles (3,436)—E. Burt.
Means for securing detachable wheels of motor vehicles to axles (3,362)—G. A. Gretton.
Elastic tires for vehicle wheels (3,227)—W. H. Henley's Telegraph Works Company and J. Traxler.
Governor for motor vehicles (3,529)—C. O. Marshall.
Trolley pole head for tramcars (3,534)—J. Pratt.
Pressing and punching machine for forming metal railway sleepers (3,381)—H. Rigby.
Devices for preventing slipping of driving wheels of motor vehicles (3,430)—E. W. Scarlett.
Railway permanent way (3,782)—W. H. Ashmore.
Electro-magnetic switches for train lighting installations (3,618)—J. Stone and Company and A. H. Darker.
Rollers for overhead tramway equipment (3,748)—J. Duggan.
Tires (3,742)—Dunlop Rubber Company.
Automatic railway signals (3,606)—H. Edwards and R. L. Edwards.
Tipping mechanism for motor wagons (3,887)—F. E. Ellis and R. H. B. Ellis.
Fastening rails to sleepers (3,705)—E. Hudson and W. S. Hudson.
Transmission gear for motor vehicles (3,849)—Lea and Francis and C. H. Ingall.
Change-speed gear for motor vehicles (3,619)—A. E. Leymarie.
Motor vehicles (3,875)—G. W. Mascord.
Motor vehicle (3,869)—F. Turnbull.
Petrol engine (3,817)—W. S. Woods.
Motor vehicles (4,231)—W. F. Brennan.

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Railroad ties (3,967)—W. E. Chesney.
Overhead trolley guide for electric tramcars (4,260)—G. R. Goll.
Motor vehicles (3,926)—A. Good.
Brake mechanism for railway vehicles (4,154)—F. J. Gresham and G. Kiernan.
Life-guards for vehicles (4,265)—London General Omnibus Company and G. Miller.
Lifting jacks for vehicles (4,182 and 4,375)—F. L. Rapson.
Starting and lighting apparatus for automobiles (4,511)—J. Bethenod.
Apparatus for automatically operating brake mechanism of trains (4,593)—A. C. Butcher.
Life-guards (4,603)—S. C. Caddy.
Catenary suspension of conductors for transmitting and transforming electrical energy simultaneously for use on railways (4,488)—W. H. Course and H. J. Guise.

FOR HIGH-CLASS
CONDENSING PLANT
WRITE TO
THE MIRRLEES WATSON CO., LTD.,
SCOTLAND STREET, GLASGOW.

STEAM AND HYDRAULIC
ENGINE PACKING
MANUFACTURERS
(Flax, Asbestos and Cotton)
And all Engine Room Stores
ATTWATER & SONS
Hopwood Street Mills, PRESTON
Telegraphic Address: "Attwaters, Preston."

Electric signalling systems (4,506)—L. Fokes and R. Lambourne.
Traction connections for automobiles (4,323)—H. A. Gill (*Staude Manufacturing Company*).
Self-propelled vehicles (4,548)—C. W. Gillett.
Manufacture of solid india-rubber tires (4,707, 4,708, and 4,709)—W. T. Henley's Telegraph Works Company and E. E. Judge.
Metallic railway tie and rail fastening (4,616)—J. W. Herman and J. A. Hyle.
Rail chairs (4,513)—D. H. Pettingell.
Apparatus for heat treatment of rails *in situ* (4,585)—C. P. Sandberg.
Railway ties (4,378)—F. C. Shearer.
Motor vehicles (4,696)—M. Walter, Limited, and W. M. Walter.

Specifications Published.

1915.

Interconnecting the electrical conductors of two railway cars (10,226)—Wollenmann.
Sensitively attaching or suspending under varying loads, axles, wheels, carriages, trams, body frames, etc., particularly applicable to vehicles (16,969)—Killen.

1916.

In the following list the numbers in italics are those that the specifications will finally bear and under which they will be indexed and abridged before acceptance and finally printed. The application numbers should, however, still be used for correspondence purposes.

Resilient tires for the wheels of motor cars (1,864—*103,694*)—A. A. Crozier.
Reinforced concrete blocks for paving tramways and railways (7,621—*100,640*)—A Garrivier.
Rail joints (11,483—*103,778*)—D. P. Parker.
Tramway and railway rails (13,332—*103,786*)—C. Spreckley.
Semi-automatic compressed air brakes for railway and tramway vehicles (1,485—*103,838*)—G. Negrini.
Regenerative braking systems for electrically-driven vehicles (12,351—*103,959*)—W. V. Turner and T. H. Thomas.
Differential gear applicable to motor vehicles (5,610—*104,073*)—T. H. Cleathero and F. Spurr.
Longitudinal sleepers for railway and tramway tracks (15,835—*102,152*)—O. Valeri.
Radiator guards for motor road vehicles (4,513—*104,247*)—D. Berrage-Moulton.
Motor vehicles (5,485—*104,252*)—A. Good.
Means of control for electro-mechanical transmissions for motor vehicles (2,920—*104,370*)—W. A. Stevens.
Self-propelled vehicles (3,111—*104,383*)—G. Watney.
Power transmission gear for self-propelled vehicles (3,112—*104,384*)—G. Watney.
Device for securing points on railways (4,793—*104,412*)—Railway Supplies Company and H. A. Braithwaite.
Hopper apparatus for distributing sand on tramway rails (7,053—*104,424*)—H. A. Forbes.
Motor vehicles (7,519—*104,427*)—H. L. Pomeroy and Vauxhall Motors, Limited.

Colonial and Foreign Tramways Traffic Returns.

NAME OF COMPANY.		1916. WEEKS ENDED.					1917. WEEKS ENDED.					AGGREGATE.		
		Mar. 4.	Mar. 11.	Mar. 18.	Mar. 25.	—	Mar. 3.	Mar. 10.	Mar. 17.	Mar. 24.	—	Wks.	1917.	Increase or Decrease.
		£	£	£	£	£	£	£	£	£	£		£	£
Anglo-Argentine		60,023	50,723	52,078	51,257	...	52,136	52,595	52,831	52,057	...	12	607,791	− 1,531
Auckland		...	20,711	(28 days)	...	...	...	21,535	(28 days)	...	...	36	193,408	+ 3,471
Calcutta	Rs.	80,039	69,048	68,244	63,886	...	70,336	69,271	67,573	64,922	...	12	832,549	+ 18,203
Madras	Rs.	...	...	32,004	(14 days)	...	28,511	(14 days)	34,167	(14 days)	...	10	168,104	+ 13,115
Pernambuco		...	...	2,865	2,825	...	...	...	3,365	3,621	...	11	39,037	+ 4,867

Companies Issuing Monthly Statements.

		1915.				1916.		1916.			1917.			Wks.	AGGREGATE.	
		Oct.	Nov.	Dec.	Jan.	Feb.	March.	Oct.	Nov.	Dec.	Jan.	Feb.	March.		1916-17.	+ or −.
		£	£	£	£	£	£	£	£	£	£	£	£		£	£
Ballarat & Bendigo ...		3,586	3,396	4,437	...	...	...	3,429	3,089	3,980	...	...	...	40	32,608	− 321
Brazilian Traction Mirs		6793000	6336000	7082000	6626000	6276000	...	7037000	6943000	6527000	7266000	6872000	...	8	14,138,000	+1,236,000
Brisbane ...		31,880	31,120	...	32,280	30,320	...	32,760	26,740	...	33,020	29,800	...	8	62,820	+ 220
British Columbia	$	538,826	562,782	603,667	591,949	572,935	...	573,544	604,576	631,644	627,130	581,555	...	34	4,647,475	+ 242,445
Buenos Ayres Lacroze		43,516	46,033	43,528	40,595	39,137	...	39,670	42,603	40,106	38,142	35,977	...	34	305,014	− 25,649
Burma		25,531	23,695	22,185	21,906	20,345	...	29,768	26,824	30,250	23,803	22,912	...	30	181,718	+ 20,734
Cape Town		...	...	...	16,030	...	...	14,238	...	...	18,440	16,229	...	8	34,669	—
Carthagena & Herrerias		2,169	2,090	2,129	2,841	1,585	2,991	2,539	2,252	2,399	3,982	3,223	2,955	13	10,160	+ 2,743
Cordoba		13,441	13,798	13,026	12,335	11,831	...	13,533	12,836	12,327	12,437	11,898	...	48	147,585	− 755
East India		2,069	2,065	2,062	2,015	1,863	2,196	2,080	1,942	2,120	1,836	1,570	1,647	35	16,240	− 350
Kalgoorlie		2,675	2,611	3,018	...	...	...	2,716	2,555	2,894	...	...	...	52	31,432	− 1,988
La Plata		4,405	4,564	4,563	4,533	4,345	4,611	4,435	4,342	4,436	4,315	4,092	4,527	13	12,935	− 556
Lima		32,211	30,720	35,110	...	...	...	33,292	33,625	35,845	...	...	...	52	406,820	+ 20,498
Manaos ...	Rs.	...	...	...	...	...	...	...	142,858	...	...	...	...	—	—	—
Manila	$	...	...	...	...	66,303	...	...	...	...	...	73,200	...	—	—	—
Mexico ...	$	...	...	...	...	...	...	...	...	...	...	...	...	—	—	—
Monte Video		27,167	28,407	31,305	34,252	32,502	31,956	...	28,404	31,364	33,341	32,304	31,979	22	157,392	− 1,030
Peruvian ...	$	806,900	751,720	823,600	862,100	775,700	...	945,590	925,820	990,842	935,130	844,770	...	34	7,285,392	+ 966,215
Port Elizabeth ...		...	...	...	4,193	3,857	...	3,131	...	...	4,498	3,553	...	8	8,051	+ 1
Rangoon		4,886	5,028	4,492	4,763	4,674	...	5,043	5,033	4,904	4,633	4,605	...	8	9,238	− 199
Toronto ...	$	792,001	851,113	...	906,350	846,256	...	907,460	911,829	...	1002469	932,567	...	8	1,935,036	+ 182,430
Winnipeg ...	$	286,146	323,025	...	297,560	293,250	...	278,817	282,899	...	319,945	280,717	...	8	600,662	+ 9,852

(*Continued on page 254*)

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TRAFFIC RETURNS—*continued.*

Tramways and Omnibus Undertakings in the United Kingdom.

NAME OF COMPANY OR CORPORATION.	1916. WEEKS ENDED.					1917. WEEKS ENDED.					AGGREGATE.		
	Mar. 4.	Mar. 11.	Mar. 18.	Mar. 25.	—	Mar. 3.	Mar. 10.	Mar. 17.	Mar. 24.	—	Wks.	1917.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Aberdare U.D. Council	319	351	331	350		395	388	370	390		51	20,025	+ 1,893
Aberdeen Corporation	1,724	1,640	1,581	1,623		1,780	1,772	1,676	1,785		42	79,380	+ 4,422
Accrington Corporation	*										—	—	—
Ayr Corporation	239	235	230	244		259	249	260	264		45	17,442	+ 1,344
Bath Electric	*										—	—	—
Birkenhead Corporation	1,384	1,317	1,372	1,359		1,504	1,486	1,542	1,543		51½	78,497	+ 7,295
Birmingham Corporation	14,554	14,662	15,324	15,311		16,445	15,483	16,668	16,424		51	813,218	+ 63,301
Birmingham Corp. Motor Omnibuses	687	695	738	732		870	746	886	842		51	49,061	+ 6,558
Blackburn Corporation	998	1,182	985	732		1,077	1,084	1,086	842		51	49,061	+ 6,558
Blackpool and Fleetwood	325	293	255	262		359	261	308	286		11	3,513	− 195
Blackpool Corporation	*										—	—	—
Bolton Corporation	2,585	2,503	2,577			2,824	2,648	2,947			—	—	—
Bournemouth Corporation	1,730	1,802	1,744	1,850		1,731	1,633	1,838	1,742		52	113,382	+ 5,537
Bradford Corporation	5,699	5,635	5,813	6,495		6,138	5,632	7,007	6,454		51	341,772	+ 12,006
Brighton Corporation	837	807	913	848		984	923	1,038	958		51½	61,672	+ 6,418
Bristol	4,053	4,089	4,229	4,328		4,752	4,485	4,640	4,819		11½	53,067	− 26
Burnley Corporation	1,533	1,503	1,473	1,453		1,551	1,442	1,622	1,580		—	—	—
Burton-on-Trent Corporation	222	235	248	242		254	262	253	254		51	14,205	− 500
Bury Corporation	1,275	1,193	1,227			1,369	1,252	1,422			50½	70,638	+ 3,050
Cardiff Corporation	*										—	—	—
Chatham and District	952	975	1,019	1,042		1,169	1,106	1,110	1,146		12	12,552	+ 266
Chesterfield Corporation	241	249	246	257		243	236	241	247		51	13,696	− 14
Colne Corporation	*										—	—	—
Cork Electric	423	418	417	456		462	437	468	495		12	5,204	− 93
Croydon Corporation	*										—	—	—
Derby Corporation	994	956	979	1,002		1,000	973	1,029	988		51½	56,492	+ 2,691
Dover Corporation	*										—	—	—
Dublin and Lucan	102	106	120	100		134	109	128	130		12	1,382	+ 39
Dublin United	5,585	5,539	5,913	5,495		5,941	5,609	6,066	5,978		12	69,248	+ 543
Dundee City	1,284	1,261	1,246	1,268		1,335	1,285	1,246	1,291		44½	61,069	+ 860
East Ham Corporation	1,117	1,132	1,161	1,172		1,163	1,163	1,117	1,204		51½	63,972	− 1,508
Exeter Corporation	294	293	314	311		344	278	291	302		51	19,807	+ 1,006
Gearless Motor 'Buses	*										—	—	—
Glasgow Corporation	21,389	21,120	21,149	20,732		24,072	23,288	23,806	24,247		42½	999,058	+ 74,687
Glossop (Urban Elec. Supply Co.)	127	114	122			127	115	132			11	1,371	− 17
Halifax Corporation	1,625	1,864	1,664	1,861		1,852	1,799	1,709	1,957		50½	108,547	+ 547
Halifax Corp. Motor Omnibuses	31	33	24	31		44	43	41	49		50½	2,473	+ 94
Hastings and District	643	649	735	691		980	828	968	855		12	10,535	+ 1,951
Huddersfield Corporation	2,578	2,468	2,542	2,540		2,683	2,457	2,703	2,684		51	142,099	+ 8,965
Hull Corporation	3,122	3,164	3,116	3,060		3,032	3,124	3,064	3,049		51	161,042	+ 1,535
Ilford U.D. Council											—	—	—
Ilkeston Corporation	*										—	—	—
Ipswich Corporation	463	449	475	497		379	357	376	373		51	24,793	− 2,629
Isle of Thanet	219	203	247	251		286	219	249	247		25	6,200	− 81
Kilmarnock Corporation	153	145	147	145		169	158	165	166		44½	7,776	+ 292
Lanarkshire	2,065	2,032	1,976	2,097		2,442	2,365	2,390	2,442		12	27,755	+ 2,423
Lancashire United	1,498	1,563	1,475	1,550		1,769	1,741	1,781	1,962		12	20,069	+ 1,564
Leeds City	8,586	8,431	8,548	8,657		9,353	8,802	9,506	9,532		52	497,377	+ 38,898
Leicester Corporation	*										—	—	—
Leith Corporation	713	715	745	735		865	832	831	839		44½	39,035	+ 4,786
Leyton U.D. Council	1,337	1,337	1,415	1,466		1,577	1,540	1,533	1,617		51	82,396	+ 1,183
Liverpool Corporation	12,812	12,362	12,650	12,775		14,295	13,589	14,183	14,291		11½	166,139	+ 10,056
Llandudno and Colwyn Bay	170	180	184	189		187	167	197	194		16½	2,969	− 87
London County Council	39,904	41 974	42,960	44,722		45.725	46,143	45,055	47,570		50½	2,394,181	+152,091
London General Omnibus	*										—	—	—
London United	*										—	—	—
Lowestoft Corporation	*										—	—	—
Maidstone Corporation	152	155	162	171		172	176	178	187		51	10,694	− 66
Manchester Corporation	17,123	16,873	17,018	17,090		18.243	17.363	18,563	18,418		49	951,479	+ 41,670
Metropolitan Electric Tramways	*										—	—	—
National Steam Car	*										—	—	—
Nelson Corporation	184	184	178	177			174	194	190		51½	10,665	+ 677
Newcastle-on-Tyne Corporation	5,726	5,483	5.683	5,787		6,936	6,667	6,912	7,147		51	345,043	+ 29,926
Newport (Mon.) Corporation	823	782	840	828		918	875	930	815		51	48,754	+ 5,208
New St. Helens and District	841	855	827	834		977	1,015	1,020	1,102		38	41,005	+ 3,118
Northampton Corporation	*										—	—	—
Nottingham Corporation	3,501	3,566	3,516	3,694		3.718	3.655	3,717	3,814		51	197,014	+ 6,814
Oldham Corporation	2,196	2,056	2.176	2,126		2.311	2 199	2,432	2,372		52	124,928	+ 6,393
Portsmouth Corporation	2,045	2,098	2,113	2,047		2,198	2,036	2,169	2,163				
Preston Corporation	955	910	904	949		1,038	1,041	1,053	1,085		50½	56,080	+ 6,212
Provincial	1,911	1,886	1,948	1,891		2,011	1,819	2,011	1,960		25	49,129	− 1,363
Reading Corporation	707	711	699	734		841	787	787	814		51½	43,518	+ 3,555
Rhondda Tramways	1,103	1,140	1,129	1.367		1,364	1,268	1,267	1,369		12	14,895	+ 1,027
Rochdale Corporation	1,531	1,454	1,501	1,497		1,597	1,455	1,680	1,662		51½	88,575	+ 2,341
Rotherham Corporation	1,197	1,173	1,261	1,247		1,569	1,574	1,633	1,629		51½	81,206	+ 19,675
Salford Corporation	5,020	4,819	4,962	4,902		5,203	4,971	5,359	5,212		51½	276,066	+ 9,474
Sheffield Corporation	9,530	9,060	9,529	9,711		10,970	10,452	11,249	11,196		52	552,828	+ 76,040
Southampton Corporation	1,373	1,386	1,371	1,399		1,559	1.554	1,532	1,632		50½	83,933	+ 7,748
Southend-on-Sea Corporation	527	527	547	616		637	615	597	641		51	44,066	+ 4,514
South Metropolitan Tramways	*										—	—	—
South Shields Corporation	734	702	707	713		792	776	779	821		51½	42,794	+ 2,583
Sunderland Corporation	1,412	1,487	1,459	1,456		1,502	1.554	1,519	1,565		51	83,792	+ 6,031
Sunderland District	543	505	525	531		653	572	610	599		21	13,057	+ 1,328
Swindon Corporation				180					217		50½	10,460	+ 577
Torquay Tramways	333	398	365	483		483	408	476	493		12	5,259	+ 485
Tramways (M.E.T.) Omnibus Co.	*										—	—	—
Tyneside Tramways and Tramroads	469	461	465	501		645	613	633	670		12	7,004	+ 1,230
Wallasey Corporation	1,103	1,034	1.077	1,095		1,169	1,112	1,191	1,188		51½	67,982	+ 3,674
Walsall Corporation	694	672	739	755		770	734	822	840		12	8,910	− 516
Walthamstow U.D. Council	727	731	787	802		955	923	945	988		51	54,040	+ 9,407
Warrington Corporation	*										—	—	—
West Ham Corporation	2,722	2.842	2,872	2,984		3.022	3,082	3,094	3,151		50½	161,182	+ 4,916
Wigan Corporation		1,513	1,125	1,494			1,586	1,273	1,755		51	85,378	+ 8,048
Wolverhampton Corporation	*										—	—	—
Yorkshire (West Riding)	1,561	1,376	1,518	1,499		1,862	1,737	1,928	1,799		12	21,503	+ 2,885

* TRAFFIC RETURNS SUSPENDED.

Owing to the European war, the Government have taken over the railways of Great Britain as from August 4, 1914, and the issue of traffic returns has been suspended. Consequently the traffic returns of the electric railways which usually appear on this page cannot be given.

The Publication of the Traffic Returns of the Tramways marked with an asterisk in the above table have also been suspended during the war.

TRAMWAY DIRECTORIES.

A useful feature of this issue is the directory of electric railways and electric tramways which will be found among the advertising pages. This directory contains the names of the chief officials and the principal particulars relating to each undertaking.

THE TRAMWAY AND RAILWAY WORLD

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"Delivering the Goods"

THIS expressive term has more than usual significance when applied to Daimler Commercial Vehicles. War service has proved that under the most trying conditions the Daimler is to be relied upon absolutely.

Here is a pre-war record from the Crosville Motor Co., Ltd., Chester:

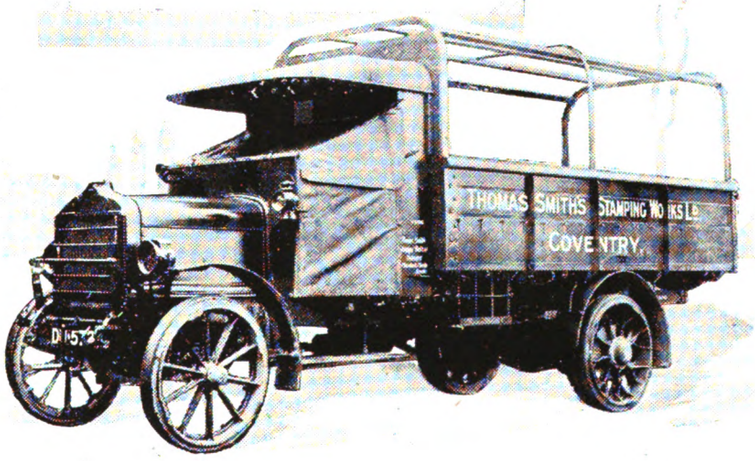
20,000 miles

Repair Bill £2 : 13 : 4

"This vehicle, bought in 1913, has now done 125,000 miles, and is still one of the best in the fleet."

The secret of this success is the Daimler Sleeve-Valve Engine, the finest materials and Daimler craftsmanship.

The Daimler Company Ltd.
COVENTRY



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MOTOR VEHICLES.

TWO MODELS

TO CARRY 30/45 CWT. & 3½ TONS RESPECTIVELY

"The Design and Construction are Throughout of a Character, which it would be Exceedingly Difficult, if not Impossible, to Improve Upon."

RAILWAY GAZETTE. MARCH 31, 1916.

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IN WAR

USED BY THE BRITISH AND ALLIED GOVERNMENTS.

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WORKS
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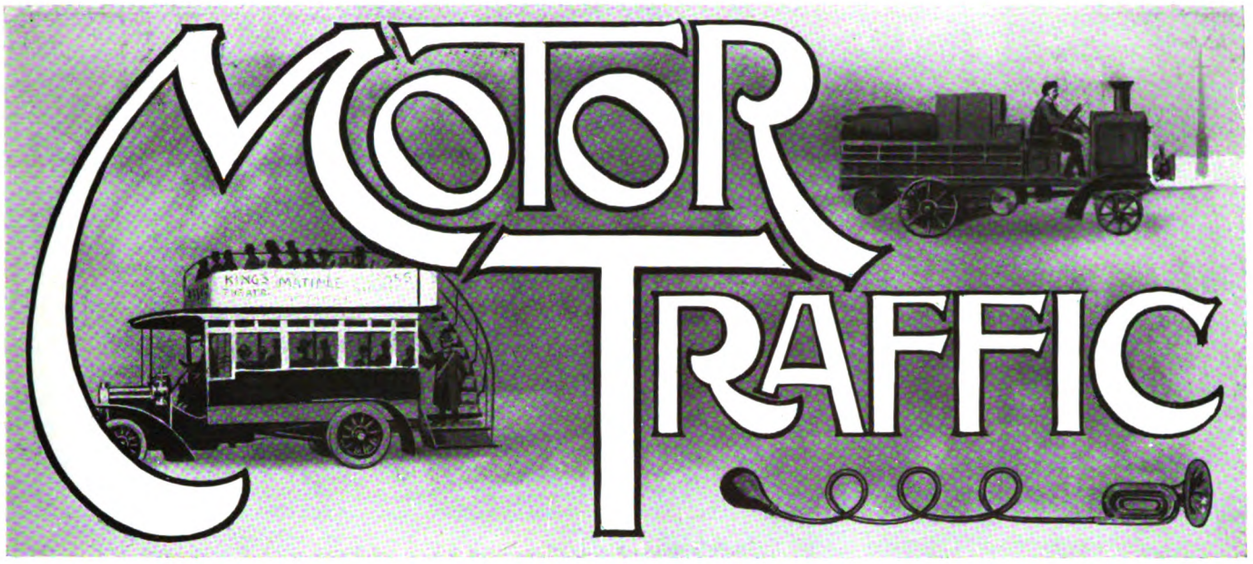

Particular interest will necessarily attach to the Government's scheme for increasing and conserving motor transport facilities. At present it is to be regarded as more or less tentative, but the experiment which has been embarked upon in the Birmingham district is capable of very wide extension in the event of its proving successful in practice. Essentially it is a project for avoiding waste mileage, and consequently unnecessary consumption of petrol by eliminating the empty lorry from the traffic of the roads. In other words, an organisation is to be set up that will secure that when a motor vehicle sets out upon a journey from one town to another with a load, there shall be work for it to do on its return trip. Of course the basis of the scheme is not new. Various attempts have been made in the past to deal with this "returned empties" problem, but it cannot be said that these have met with any remarkable degree of success. The endeavour to organise return-load arrangements has at the outset the defect that it introduces an element of complication in transport which may easily neutralise its possible advantages. In the first place, no firm carrying on road transport, whether it be a haulage contractor rendering service to someone else or the delivery department of a concern engaged in ordinary commercial enterprise, can indefinitely adapt its schedules of journeys to conditions not strictly relevant to its own direct needs. In the second place, the demands of the consignee have to be met. When to these two factors a third has to be added—i.e., that of obtaining a suitable return load—it will be seen how difficult in practice any scheme having such an object must be. No doubt actual experience of its working can help to overcome some of its complications, and it is possible that the exigencies of the war may tend towards this result. Transport organisations of all kinds are so depleted both of material and men that nobody expects either the same promptitude or the same rapidity as they would have looked for in normal times. Consequently there is a greater margin of elasticity available for those whose business it is to move goods from place to place—whether as haulage contractors or otherwise—than there might have been in the more exacting conditions of normal times.

* * * * * *

In the ordinary way, as already pointed out, this margin of elasticity—or adaptation to what may be called external considerations—is comparatively small. The consignor wants, as a rule, to despatch his goods on a certain date, and the consignee wishes to receive them within some definite limit of time, and if the work is done by a contractor it has to be fitted in with his other engagements. If to these factors we have to add that of getting a return load, it will be realised that an element of uncertainty, difficulty, and possible waste of time and money is introduced, and that this is easily calculated to neutralise entirely any economy that might result from returning home loaded instead of empty. If we could always be sure that the tonnage of merchandise to be sent by road as between London and, let us say, Birmingham or Brighton, was always the same in both directions, and of approximately similar distribution as regards time, the return load scheme might confidently be expected to become a permanent feature in our transport arrangements. We know perfectly well, however, that this is very far from being the case. For that reason, even in the greater degree of "give and take" that exists in view of war conditions, and the less exacting standards of service now prevailing, there is but little prospect of anything like universal success for the Government scheme. It may be found to answer in a rough and ready way, in the somewhat exceptional conditions that obtain in the Birmingham area. But wherever it may be tried or applied, the inherent drawback of any return load scheme—its complexity in practice—remains constant, and it is only a question of degree, dependent upon local conditions. At the best they may be such as to render it barely worth while, and at the worst they may involve hopeless confusion and economic loss. As yet transport economy is not likely to be attained or transport difficulties solved by artificial centralisation, and all the return load schemes yet put forward, including those of the Government, appear to be subject to this capital defect.

By no means the least important of the questions that must be dealt with in the period immediately succeeding the war is that of the future of the British motor industry. One may leave out of consideration for the moment any suggestion of protective tariffs, or other restrictive measures affecting foreign competition. The broad result to be aimed at is that the industry should receive at the hands of the Government elementary fair play, and that every possible facility should be afforded for the various manufacturers to resume their normal activities without unnecessary loss of time or goodwill. This is a matter not merely of justice to a great and important industry, but also an appreciable factor in the trade recovery upon which

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the country depends to re-establish itself, and to help it in repairing the economic wastage of the past thirty months. It may be politically necessary for the British motor industry to reconcile itself to a State policy of fiscal neutrality so far as overseas rivals are concerned. There is so much to be said on both sides of the controversy of protection *versus* free trade that the issue must, for some time to come, remain in doubt, and all the more so because the question is partly a political one and partly economic. British motor manufacturers therefore must be prepared in the ultimate resort to carry on without actual fiscal assistance from the State. They are, however, entitled to demand that there shall be no deliberate loading of the dice against them—that whether the country can see its way to assist them against their foreign competitors or not, it shall, at all events, refrain from giving aid of any kind, direct or indirect, to the latter. That the necessities of the war have in themselves tended towards this unfortunate result must be regarded as more or less inevitable, and though it must be counted as unfair that British motor manufacturers should have been compulsorily diverted from their ordinary activities, whilst their competitors were left unhindered, it was simply one of those things that could not be helped. Throughout the war the country has, however, been treated to the spectacle of important enterprises being turned over to work other than motor car building, and at the same time large Government purchases of American-built cars. This, again, may have been unavoidable, but it serves to emphasise the necessity for not carrying the process of discrimination against our own enterprise any farther. Indeed, to do so is not only unnecessary but positively mischievous. Unnecessary and mischievous are the only terms one can apply to the policy involved in the license granted to Mr. Henry Ford in connection with his new factory at Cork. It is true that a principal condition of this license is that nothing but agricultural tractors shall be made at this establishment until after the war. This proviso is excellent in theory—ignoring for present purposes the question of whether the agricultural tractors to be produced at this new Ford factory might not equally well be built in this country. In practice, however, the whole proposition is open to the gravest objections, and considerable weight must attach to the protest made against it on behalf of the British motor industry. In this protest it is pointed out that it is highly unlikely that any such factory as that projected can be constructed and set to work so promptly as to produce an output before the probable end of the war. Consequently it is felt that this prohibition amounts to very little. If the Government adheres to its present attitude it will be in the position of assisting the foreign competitor, and hindering home enterprise, which will find itself opposed by a factory in full working order, able to turn out large quantities of cars as soon as peace arrives. A considerable time must elapse before the British manufacturer can reorganise his resources from a war to a peace footing, and then he may find the market monopolised by a foreign maker to whom special facilities have been granted.

THE METROPOLITAN ASYLUMS BOARD have accepted the tender of the following firms for the supply of tires for motor ambulances and lorries, the guaranteed mileage of the solid tires being 10,000:—Avon Indiarubber Company, Shrewsbury and Challiner Tyre Company, Grimston Tyres Company, and the St. Helens Cable and Rubber Company.

RATIONING OF PETROL SUBSTITUTES.

Mr. H. W. Cole, secretary of the Petrol Control Committee, on March 10 issued the subjoined notice to owners of motor vehicles:—

"The restrictions which have been imposed on the use of petrol have led to a considerable increase in the consumption of petrol substitutes. The importation of these substitutes requires the use of tonnage which it is absolutely necessary to economise. The Petrol Control Committee are therefore compelled to take measures for the limitation of the consumption of petrol substitutes used in motor vehicles, and the attention of all owners and users of motor vehicles is called to the following order which is being issued to all licensed dealers in motor spirit, and will have effect as from March 10:—

"The sales of all substitutes for petrol which are sold for use in motor vehicles must be entered on the motor spirit licence held by the purchaser.

"The monthly quantity of petrol and substitutes purchased by the owner of any motor vehicle must not exceed the monthly quantity of motor spirit authorised by the Petrol Control Committee to be purchased."

FURTHER RESTRICTIONS FORESHADOWED.

In the House of Lords on March 28, Lord Hylton, answering Lord Strathspey, said owing to the increasing demands for petrol by the military authorities, the present shortage of supply was likely to be accentuated, and it would be necessary to take steps further to restrict supplies to consumers. A large quantity of petrol was consumed by motor omnibus companies, and it was proposed to reduce the supply of petrol to them by about 20 per cent. This would involve a corresponding reduction of services. Owners of cars used for purely private purposes would not receive any allowance of petrol at all after their present licences expired, and even in the case of a private car employed in public work the petrol allowance would be cut down in all probability to a maximum of 10 gallons a month, except in a few special cases where a car might be used for work in connection with the war.

In the House of Commons, on March 26, Mr. Duncan Millar asked the Prime Minister whether his attention had been directed to the number of motor cars which were used in conveying passengers to the race meeting held at Gatwick on the 21st inst., which included a number of high-powered private cars, many of which were quite new, and to the consumption of petrol on that occasion, estimated at some 2,500 gallons, and whether he would take immediate steps to prohibit the use of motor cars for race meetings at the present time.

Mr. G. H. Roberts (Parliamentary Secretary, Board of Trade) replied that it was not proposed to prohibit the use of motor cars at the very limited number of race meetings now permitted. He might say, however, that no new licences were now being issued by the Petrol Committee for the supply of petrol to private cars not used for national purposes.

THE EFFECT ON OMNIBUS FARES.

The further restriction alluded to above, combined with the decree that petrol substitutes must be reckoned in the allowance of petrol for which licences are issued, is likely to result not only in the reduction of services, but in higher fares. At Sheffield the Corporation Tramways and Motors Committee, early in March imposed an addition of 25 per cent. on the omnibus fares charged to places beyond the city boundary, and on March 23 the London General Omnibus Company curtailed a number of their services. This has drawn protests from the public, but the reductions will, it is understood, have to be extended as times goes on. Some districts are already without 'buses, and the closing of London railway stations and increase of fares accentuates the great inconvenience.

Further enforced taking off the road of omnibuses will, it is stated, inevitably result in an increase in fares. The omnibuses maintained will only carry a certain number of people, and the fewer vehicles there are the higher must be the fare charged. Care has evidently been taken to continue routes upon which hospitals for the military are situated, and those used by munition workers. The pleasure routes were the first to go. The question with reference to the omnibuses is as to whether they are performing a national service, and there can be no doubt that they are, especially in providing means of transit for so many thousands of war workers. If the restriction as to use of substitutes is not withdrawn drastic reduction of services and higher fares must ensue.

Interviewed on the subject on March 28, Mr. H. E. Blain, operating manager of the London General Omnibus Company, said:—"Although we took 15 per cent. of our omnibuses from the streets last week, I am not surprised that we have to effect a further reduction in the service. It is regrettable because the public need for

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omnibuses was never so great as it is now, when so many suburban stations are closed, railway fares have been increased, and an abnormal number of girls and women come to business from the suburbs."

Reduction in London Omnibus Services.

In consequence of further restrictions in the supply of motor fuel, the London General Omnibus Company withdrew on March 30 the following routes: Kilburn and Tower Bridge, Wimbledon Park and South Hackney, Wanstead and Epping Town, Stroud Green and Putney, Teddington and Highgate, Woodford and Victoria, Clapham Common and King's Cross, Crystal Palace and Shepherd's Bush, Walham Green and Camden Town, Barnes and King's Cross, Putney and Camden Town. At the same time reductions were made in a number of other services. Further reductions in the services on other routes will be necessary as soon as they can be arranged. Certain adjustments will also be made to afford connections which the public need.

ARMY APPROPRIATION ACCOUNTS.

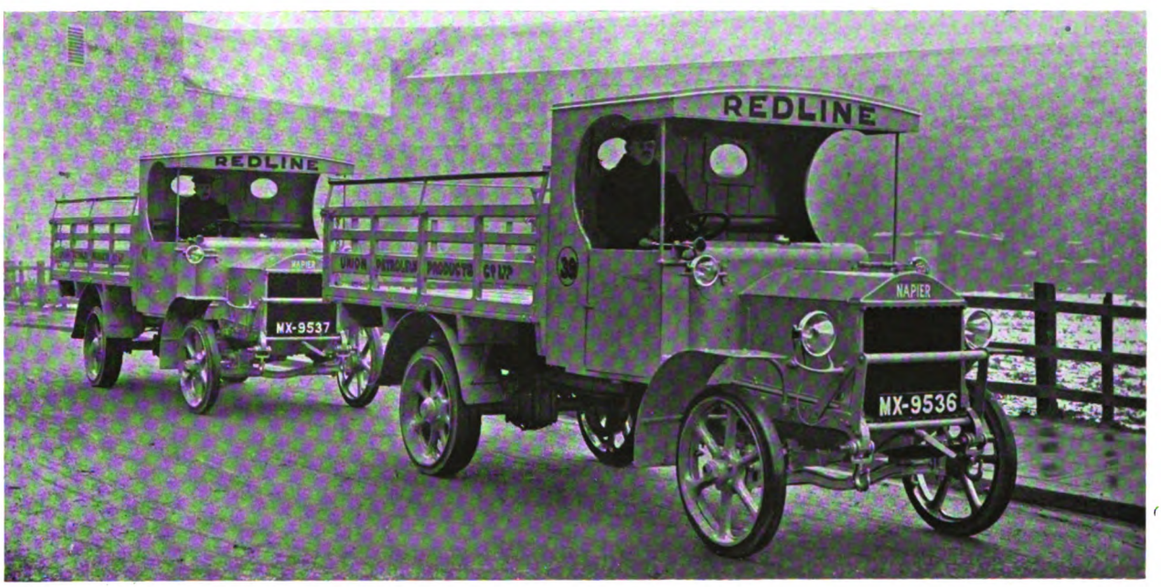
Impressment of Omnibuses—Mechanical Transport Drivers.

In the Army Appropriation Accounts for 1915-16, issued on March 26, reference is made by the auditor to the taking over of London General Omnibus Company's vehicles. No definite agreement as to compensation was made. Protracted negotiations followed, and a settlement was reached at £585,000 as against a claim of £626,873.

Another matter referred to by the auditor is the payment of a considerable sum to an omnibus company for the instruction of mechanical transport drivers who were receiving 6s. per day and had been enlisted on the understanding that they were already qualified drivers.

NAPIERS FOR PETROL DISTRIBUTION.

Through the agency of the two 30/45 cwt. motor wagons illustrated on this page, and supplied by D. Napier and Son, Limited, New Burlington Street, London, W., the Union Petroleum Products Company, Limited, London, have freed themselves from the delays now unavoidable in the railway service. The Union Petroleum Products Company, Limited, are engaged in supplying petrol to the various Government depots, and they felt the need of a reliable vehicle that could undertake this important work. Napier business vehicles can only be supplied to such firms as are doing urgent Government work, in which case release is granted.



Napiers for Petrol Distribution.

Salford Gas Committee have ordered a 3½-ton Sentinel steam wagon, complete with hydraulic tipping gear and rubber tires, from Messrs. Alley and MacLellan, of Shrewsbury.

THORNYCROFT AIRCRAFT GUN CHASSIS.

Since the outbreak of war, Messrs. J. T. Thornycroft and Company have supplied a number of their 40 h.p. type "J" chassis to the War Office with special stiffened frames to carry anti-aircraft guns, the guns being fitted up by the military authorities themselves.

An interesting official film has recently been taken showing the Thornycroft anti-aircraft gun chassis in action, and one of these illustrations, which has been enlarged from the War Office film, is here reproduced.

Since the supply of motor vehicles for military purposes has been taken over by the Ministry of Munitions, thus bringing arrangements for these into line with those for the supply of guns, shells, and other munitions of war, Messrs. Thornycroft have, at the instance of the Ministry of Munitions, put in hand further extensions to their Basingstove works in order, as soon as possible, to double the output of their type "J" chassis, as the experience gained with the large number of these 3-ton machines already in service has created an urgent demand for them on all fronts.

Forfarshire Council are considering a report prepared by the surveyor in favour of replacing horse haulage by steam vehicles.

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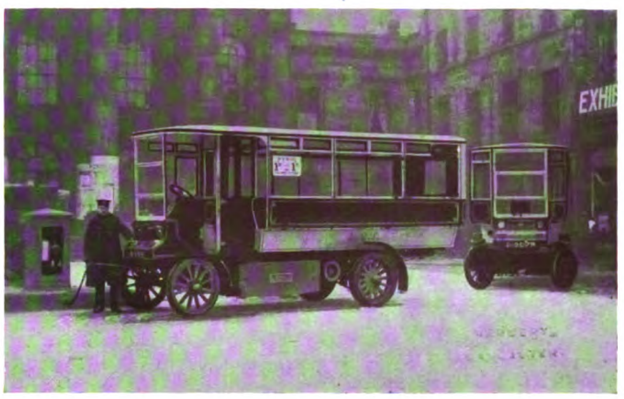
LANCASTER ELECTRIC OMNIBUSES.

PAYMENT TO THE DRIVER ON ENTRY.

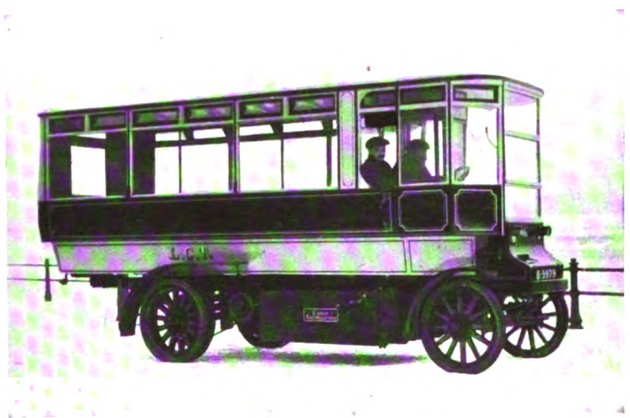
Supplementing the announcement in our issue of March 15, that the Lancaster Tramways Committee had decided to purchase two more battery-propelled omnibuses, it may be stated that the department have been operating three Edison accumulator omnibuses during the past four months. We are indebted to Mr. J. B. Patterson, the acting borough electrical and tramways engineer, for the photographs reproduced on this page, showing one vehicle from the



Front Entrance and Boosting of Battery—Lancaster Electric Omnibuses.

driver's side on the esplanade, while the other illustration shows the front entrance and also battery undergoing boosting. These vehicles constitute one of the few instances in this country of stage carriages operated by only one man, who drives and collects the fares when the passengers enter.

The three Edison "Detroit" chassis were supplied by Edison Accumulators, Limited, of London, while the bodies were built by the Brush Engineering Company, of Loughborough. Another feature of the body is that protection from the weather is afforded



Driver's Side of Lancaster Electric Omnibus.

to the driver and to the passenger on entry. Seating accommodation is provided for 22 persons, and the popularity of the vehicles is shown by the fact that the receipts are on an average 14·3d. per mile. From the point of view of reliability and regular running, the omnibuses have given entire satisfaction to the Tramways Committee. As to the working cost per car-mile, it is expected that the total will not exceed 9d., this figure including repayment of the capital cost in six years, interest, repairs, wages, and electrical energy.

The two additional omnibuses now on order are being supplied by Electromobile, Limited, of Leeds, and are fitted with Ironclad batteries, the vehicles being described as nearly "All British." The comparison of working costs of the two types of electric omnibuses after an adequate trial will be awaited with interest.

THE FOOTPATH RULE.

DOES IT CONTRIBUTE TO ROAD FATALITIES?

The London Safety First Council, appointed at a conference of representatives of public bodies, vehicle workers, omnibus and railway companies and transport firms in December last, are recommending to the authorities and the public that the present rule of the footpath, "Keep to the right," should be changed to "Keep to the left."

The Council state that, having consulted leading traffic experts and examined statistical and other data, they have arrived at the conclusion that the danger of accident will be greatly diminished if pedestrians acquire the habit of keeping to the left.

In 1916 nearly three times the number of fatal accidents occurred to pedestrians who stepped off the footpath from the near side, as compared with those which resulted from leaving from the off side, when the pedestrian is facing the traffic coming towards him or her.

Mr. H. E. Blain, operating manager of the London General Omnibus Company, upheld the recommendation of the Safety First Council in recently discussing the reduction of 18 in the number of street fatalities (83) in the county of London from the beginning of the year to February 28, as compared with the corresponding period of last year. The number of deaths attributed to omnibuses is 29 in the whole metropolitan area, which is six times the size of the county of London. Mr. Blain stated that "of the 29 people killed by omnibuses since the beginning of the year 22 were killed after dark, 21 being males and 8 females. The majority were people over fifty years of age. Many of these accidents were due to people stepping off the kerb with their backs to the oncoming traffic. This custom is largely due, I think, to the existence of the rule of keeping to the right on footways." Mr. Blain added that the speed of the omnibuses is legally restricted to 12 miles an hour, and any driver who gets ahead of the time allowed for his journey is fined. No fine is imposed for being behind time.

WAR USE OF BRISTOL MOTOR SERVICES.

N.S. VOLUNTEERS FOR TRAMWAYS AND OMNIBUSES.

In his speech from the chair at the annual meeting of the Bristol Tramways and Carriage Company, Mr. S. White mentioned that more than 400 of 1,600 employees who had gone into the army were fully-trained motor drivers, and these drivers had been particularly sought after by the recruiting officer by reason of their training and efficiency. The total number who had joined the forces from both departments of the company was equal to 70 per cent. of the staff, excluding those engaged on munitions. Such a depletion of their staff had necessitated considerable reduction of their services at certain hours, but as showing that the importance to the community of ample services of tramway and omnibuses was recognised, it might be mentioned that these industries had been included in the list of reserved occupations in connection with questions of military service, and that under the scheme of National Service volunteers were asked for to enrol for work on tramways and omnibuses

Notwithstanding the lesser number of vehicles running, the receipts had been more than maintained, and the war workers' traffic had been amply provided for. All over the country tramway undertakings had raised the fares, but Bristol had refrained from such step in connection with any of their public services, whether tramways, omnibuses, or motor cabs. With regard to omnibuses and cabs, the difficulties caused by the loss of men for military service had been added to by the increasing restriction of petrol supplies. The number of vehicles had had to be reduced, though he was glad to say that the receipts had not been diminished to a corresponding extent.

MECHANICAL TRANSPORT SUPPLY.—Mr. Percy Martin has been appointed Director-General of Mechanical Transport Supply and of Petrol Engine Supply, Ministry of Munitions, in succession to Sir Albert Stanley. Mr. Martin had already for some time been discharging the duties appertaining to the second part of the title of the now combined department, the offices of which are at the Grand Hotel, Northumberland Avenue, W.

OMNIBUSES AND ROAD LITIGATION.—Lancashire County Council have issued a writ against the Barrow-in-Furness Tramways Company, one of the British Electric Traction group, to recover £2,311, extraordinary expenses incurred in the repair of the Barrow and Ulverston Road, by reason of damage caused by the company's motor omnibuses from April 1, 1914, to March 31, 1916.

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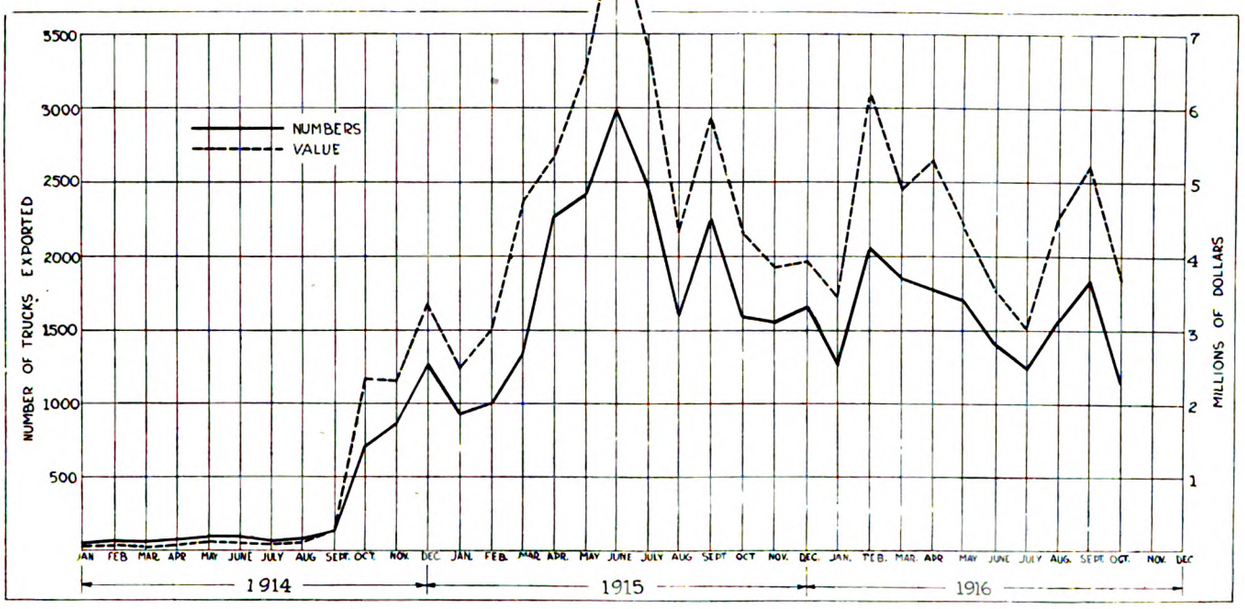
MOTOR LORRY EXPORTS FROM THE U.S.A.

The *Commercial Vehicle* of New York, in a recent issue, states that exports of motor chassis from the United States at the present time are only about 42 per cent. of what they were at the high-water mark reached in June, 1915. In that month almost 3,000 trucks, valued at more than $8,500,000 were shipped abroad. Since that time they have steadily decreased in both number and value with but five exceptions. In each of these five months the vehicles exported exceeded those of the months immediately preceding.

The war has, of course, been responsible for the great increase in motor truck exports. This is strikingly shown in the accompanying diagram, in which the heavy black line shows the variations in the number exported from month to month and the dotted line the monetary value.

In the seven months preceding the declaration of hostilities on August 1, 1914, the average number of trucks exported per month was 65. Then the governments of France, England, and Russia, realising their inability to produce trucks fast enough to meet their tremendous military transport needs, sent representatives to the United States to buy what was available.



Motor Lorry Exports from the United States, 1914-1916.

In September, 1914, the number of trucks exported was double the average number shipped in the eight preceding months. Then as American factories were enlarged and put under high working pressure to fill the orders placed, the exports increased by leaps and bounds to the high-water mark in June, 1915. This increase was steady with the exception of but two months, when sufficient shipping could not be secured.

The trucks shipped abroad up to the high-water mark were used almost exclusively for war purposes. Since that time, an increasing proportion of the exported vehicles have gone into commercial service in the warring nations to replace those private vehicles commandeered during the first stages of the war.

In all 41,441 trucks, valued at $112,865,887 were exported during 1914, 1915, and ten months of 1916. Although the high-water mark was reached in June, 1915, the exports of the other months of that year were so much smaller that the 1916 exports will be approximately 92 per cent. of those in 1915 in value and 90 per cent. in number if the average rate of the ten months of 1916 is maintained. The average value per truck exported during the entire period was $2,720.

Number of Commercial Vehicle Makers for 1917.

The annual specification tables covering petrol, electric, and steam commercial motor vehicles for 1917 show that there are 211 manufacturers of commercial vehicles. Of that number 200 are building petrol lorries, two steam, and nine electric vehicles. The models range from 10 cwt. to 7 tons and over, but of the latter there are only 18 types, five of them being electrically-propelled. Those of over 7 tons are tractors. Ninety-eight makers are building vehicles of 2-ton capacity, fifty-six manufacture 1½-ton machines, and fifty-three produce the 3½-ton type. The Ford Motor Company, of Detroit, confine their production of commercial vehicles to the 1-ton class.

In addition to nine manufacturers of electric commercial vehicles there are ten who produce what are termed electric industrial vehicles. These, however, do not offer so wide a range in capacity as the electric commercial cars. The latter comprise the following capacities :—10-cwt., 15-cwt., 1-ton, 1½-ton, 2-ton, 2½-ton, 3½-ton, 4-ton, 5-ton, and 7-ton. Only three types are shown among the industrial class, viz., 1-ton, 2-ton, and tractor.

Pneumatic tires are fitted to the 10-cwt. and to the majority of the 15-cwt. machines, while eight of the 1½-ton and one of the 2-ton type are so fitted. In addition to solid rubber tires there are cushion tires.

Two Years' Sales of Cars and Lorries

Despite the vast export of American cars and lorries to Europe in 1915 and 1916, the greatest part of the American production of motor cars was sold in the home market. Of lorries, however, the majority went to the nations engaged in war against Germany. The appended statistics show the sales and values of the two classes of vehicle for the past two years :—

	1915.	1916.
Passenger cars sold	842,249	1,525,578
Motor lorries sold	50,369	92,130
Total production of motor vehicles...	892,618	1,617,708
Retail value of passenger cars ...	£113,171,290	£184,275,600
Retail value of motor lorries ...	25,184,500	33,330,055
Total retail value of sales	£138,355,790	£217,605,655
Average price per car	£134 8s.	£121
Exports in first ten months ...	53,380	67,616
Value of exports, first ten months ...	£18,886,886	£20,009,527

The National Automobile Chamber of Commerce estimates that there were last year 3,500,000 motor vehicles in use in the U.S.A.

American Enterprise in Pekin.—It is reported from Pekin that an American company have obtained sanction from the city authority to inaugurate motor transport of passengers and goods between the centre of the city and the surrounding district. The same company have also undertaken to make the roads suitable for the traffic. Roads in the province of Chi-li are also being reconstructed for a similar purpose. In view of the lack of adequate railway facilities China is likely to become a ready market for motor vehicles.

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MOTOR TRAFFIC.

THE MOTOR TRADE AND TARIFFS.

Mr. Arthur Goodwin, of C. A. Vandervell and Company, has been elected for a second year of office as president of the Motor Traders' Association, which has 4,000 members in the United Kingdom. During the past year Mr. Goodwin's work on behalf of the association has proved of great value. The association was founded by manufacturers, and its first president was the chairman of the Daimler Motor Company. Its council consists of three classes of members, in equal proportions, viz., (1) manufacturers of motor cars, (2) manufacturers of tires and accessories and factors, and (3) retailers, so that there is always a dominating majority representing manufacturing interests.

It is of interest to note that Mr. Goodwin is the latest well-known worker in the motor industry to be interviewed by the *Financial News* on the question of post war policy of the trade and the institution of protective tariffs as advocated by Mr. C. A. Vandervell. Other gentlemen interviewed have been Mr. E. M. C. Instone, of the Daimler Company; Mr. H. T. Vane, of D. Napier and Son, Limited; Mr. T. H. Roberts, of Wood-Milne, Limited; Mr. J. Nuttall, of Beisize Motors; and Mr. S. Straker, of Straker-Squire, Limited. The event proved that, with one exception, all strongly endorsed Mr. Vandervell's views.

In the course of his remarks Mr. Goodwin said :—" In the past, as Mr. Vane has so aptly put it: 'We have been a very hospitable people; but in the near future it will be our serious business to keep the house over our heads.' I like the suggestion of treating neutrals in the most friendly manner imaginable—by treating them just exactly as they behave to us! I can endorse without qualification his denunciation of the misuse of the word 'British' in connection with businesses having nothing British about them, excepting a local habitation and a name—the former a dumping ground, the latter a disguise. While I am in favour of the protective tariff, I would prefer to treat the case of any particular foreign competitor upon its own particular merits. If our programme 'placed' Allies in the most favourable category, neutrals in a less favourable category, and enemies in a most unfavourable category, would the fact that America, at the eleventh hour, became an ally, materially change our post-war trade policy in relation to that country? I do not think it would.

Specialisation and Standardisation.

" As Mr. T. H. Roberts, speaking for the British tire industry, has pointed out, the American manufacturer has taken the utmost advantage of our tied-up condition, and has done everything, by cutting prices in the colonies, and by giving big discounts, to capture our trade. We can hardly allow a death-bed translation from the category of neutral to the category of ally to obscure the fact that for two and a half years America has cut into our unprotected vitals, nor to tie our hands in the future. Speaking personally, I should prefer not to prejudice our future trade action by drawing definite lines of demarcation to-day. My own hope in that connection is that this war will lead to a reduction of the number of those enemies, by the linking-up of certain national trade interests through the machinery of fiscal reciprocity—an extension of the Empire idea, to cover, un er whatever conditions may be found workable, at least some of those peoples who have stood with us in the war."

" Do you hold, with Mr. Straker, that our methods are open to improvement—that they must come up for revision and reconstruction? Or on what lines should we develop our interests? "

" I should prefer not to take a line that would savour of advice to other manufacturers as to how they should conduct their businesses In the C.A.V. electrical business we have been careful to perfect our methods, in anticipation of American competition. And we have done that by robbing the Americans of their 'specialisation' thunder—which, incidentally, was not so wholly theirs as all that. I daresay that Mr. Straker was entirely right in suggesting that in the motoring industry much improvement was possible. And, if I may judge from my own experience, that improvement must take the form of much more intensive specialisation, with standardisation for its outward and visible sign."

Mr. Sydney Straker and Single Unit Conditions.

Mr. Sidney Straker, when interviewed, insisted that the system hitherto in vogue in this country has got to be readjusted to deal with the new conditions, and that the world's experience in respect of production must be drawn upon and turned to the best account. All large factories, in his opinion, have been manufacturing too many types, and these it will be necessary to reduce substantially in order to get full value from the works. It is a question, he is disposed to believe, whether many of our manufacturers realise, as they should, the exceptionally low production cost procurable when working under single unit conditions. It is his opinion that the main features imperatively demanding attention as controlling the destinies of the industry in this country are four: Special machinery, large outputs, secure markets, and adjustment of labour conditions.

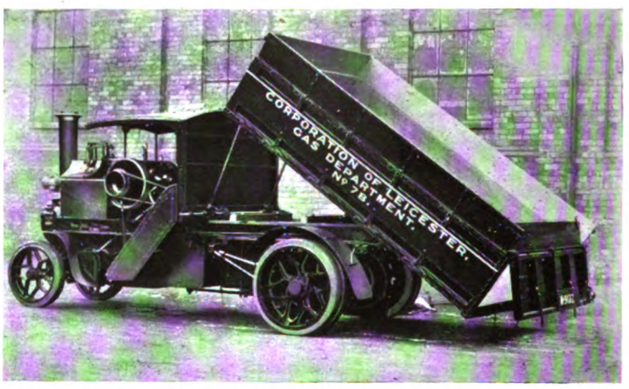
POOLING PETROLEUM DISTRIBUTION.

In the House of Commons, on March 28, Mr. Joynson-Hicks asked the President of the Board of Trade whether, at the request of the Ministry of Munitions and the Admiralty, a recent attempt was made to pool all petroleum products in this country and so economise in transport and personnel; whether the Shell Company, the Standard Oil Company, and other producers all agreed, but the German-owned British Petroleum Company, the control of which was with the Board of Trade, refused to agree; and why this was so.

Mr. Roberts said the Ministry of Munitions, the Admiralty, and the Board of Trade had intimated to the principal importing and distributing agencies of petrol products in the country the desirability of coalescing their organisations, and a scheme would shortly be in full working order. The answer to the second part of the question was in the negative, and the last part therefore did not arise.

FODEN STEAM WAGON FOR MUNICIPAL WORK.

Subjoined is an illustration of a 5-ton steam wagon supplied to the gas department of Leicester Corporation. An order for a similar vehicle has been received from Sheffield Corporation. This model is fitted with tipping apparatus and rubber tires. The body is



10 ft. long by 6 ft. 6 in. wide, by 3 ft. deep. The high state of efficiency to which the Foden vehicle has been brought at the Elworth Works, Sandbach, has proved of great advantage for heavy traction during the war, its economical running and freedom from breakdowns being very pronounced.

Karrier Staff Annual Gathering.—For several years past it has been customary for the staff of Karrier Motor Works, Huddersfield, to have an annual dinner, but this year, owing to the food problem, and for patriotic reasons, the dinner was abandoned, and a smoking concert was given on March 24. About 70 gentlemen, including visitors, directors, members of the executive, office staff, and works staff attended. Mr. R. F. Clayton was in the chair. Mr. J. E. Roberts (Messrs. Abraham Roberts) proposed " Success to Karrier Cars." Mr. Roberts has known the firm from its inception, and has been associated with the directors for at least 18 years. He referred to one of his favourite mottoes, " Masters and foremen foremost," and explained how those who were doing their " bit " conscientiously were furthering the welfare of the country. Mr. R. A. Jones, who until recently was a lieutenant in the Motor Transport, but has been " released " in order to devote his energies to works promotion matters, remarked what pleasure it gave him to be once more in the busy hive of which he is one of the directors. The chairman expressed the directors' appreciation of the *esprit de corps* of the staff, and their gratification in seeing such evidence of camaraderie around him.

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MOTOR TRAFFIC.

PIONEER IN TRACTION AND FLIGHT.

THE LATE SIR GEORGE WHITE'S SERVICES TO THE NATION.

A graceful tribute to the work of the late Sir George White, chairman of the Bristol Tramways and Carriage Company, Limited, was paid at the annual meeting of the company on March 19 by Mr. S. White, J.P., the new chairman. He could not, he remarked, express his feelings on finding that after the long period of 42 years they were deprived at that meeting for the first time of the presence of the late chairman, who was always the life and soul of every enterprise with which he identified himself. The company might rightly be looked upon as his child. He was appointed secretary at its formation in 1874, and he became more and more responsible for the direction of its policy, and for the great developments of its operations. When mechanical street traction first became practicable, he was quick to make this company a pioneer in its introduction. Tramway systems in Bristol, Dublin, Middlesbrough, and London were constructed on his initiative, and there soon followed deputations from all parts of the country to Bristol to see its installation, with the result that companies and corporations soon followed the Bristol lead, and an electric tramway system became a necessity of life in every community of any size. Later on motor traction was introduced, and here again their late chairman grasped at once its possibilities. Long before the experimental stage had been passed, it was introduced to Bristol by this company, enabling them to obtain the experience for arriving at the present advanced stage to which the industry had developed. Following motor traction came aviation, and it would not be too much to say that the nation owed a debt of gratitude for the first establishment in Bristol on a large scale of the business of aircraft construction, enabling at the outbreak of war the immediate supply of aircraft and trained pilots, a need of vital importance to the nation at a time when other sources of supply were for all practical purposes non-existent.

DEMOUNTABLE TIRES.

A PRODUCT OF THE B. F. GOODRICH COMPANY.

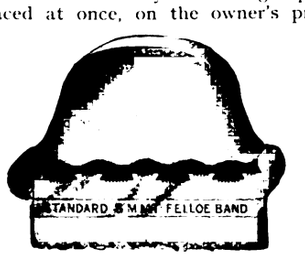
The illustration produced on this page shows the demountable tire for commercial vehicles introduced by the B. F. Goodrich Company, Limited, 117-123, Golden Lane, E.C. At present it is made in inch sizes only, but it is in wide use in the Colonies, where the conditions demand a tire constructed on simple lines—easy to fit or remove, yet secure and reliable. Fulfilling these requirements, it will appeal to owners of commercial motors whose fleet is not large enough to justify the purchase of a hydraulic press, or whose headquarters are at some distance from an established fitting depot. Any ordinary wooden wheel may be readily converted for use with this type of tire, which is suitable both for single and twin rims, and its special advantages may be summed up as follow :

1.—Can be fitted or detached in a few minutes with an ordinary spanner.

2.—Extremely simple, yet perfectly secure.

3.—Easily removed after any length of time.

4.—Effects considerable economy in running expenses, as a worn tire can be replaced at once, on the owner's premises, without



placing the vehicle out of service. This saves the time and cost of carriage involved in sending away wheels to be fitted.

5.—The tire itself is of precisely the same quality as the Goodrich pressed-on type, which means that it is full of life and resiliency, capable of resisting road shocks and absorbing vibration throughout 'ong service.

The illustration shows the rubber tread built up on a steel foundation ring (" D "), which is divided into four segments to allow for expansion when fitting the tire to wheel. The ends of this ring slant, so that when the side flanges (" A ") are contracted, by tightening the bolts, the segmental steel base of the tire is forced in the direction of the double arrow (" B ") through the action of the bevelled edges of the flanges and steel base of the tire (" D "). As an added preventive against circumferential creeping, one transverse key is secured to the steel band fitted round the felloes of the wood wheel, with which a corresponding keyway in the tire registers.

LONDON GENERAL OMNIBUS COMPANY.

The report of the London General Omnibus Company for the past year shows that the gross receipts amounted to £3,920,736, and the expenditure to £2,688,779. The sum of £198,330 is allowed for depreciation of leases, plant, machinery, etc., and the reserve for contingencies and renewals, leaving a balance at the credit of the revenue account of £205,626. Adding the balance from the last account of £23,237 and interest and dividends on investments, £73,092, there is a balance of £301,957. Interest and amounts written off preliminary expenses and discount on issues of debenture stock absorb £116,490, leaving a profit balance of £185,467. An interim dividend of 5 per cent. had been paid, and a further dividend of 3 per cent. -making 8 per cent. for the year—leaving a balance to be carried forward of £21,417. During the year the company has spent £26,057 on the purchase of land and the construction and equipment of new garages.

REDUCED DIVIDEND FROM THE ASSOCIATED EQUIPMENT COMPANY.

The issue of the report of the Underground Electric Railways Company of London explains the falling off in the recent dividend statement of the allied companies. The net income from investments was £42,700 less, at £664,666, and its interest and guarantees, plus income-tax where paid, required £227,853, leaving a surplus of £436,812, as compared with £477,307 reported a year ago. The income-tax paid on the bonds, and the loss on foreign exchange in respect of coupons encashed abroad, amounted to £134,015, an increase of £56,805, whilst the income received from the Associated Equipment Company was £143,000, as compared with £170,000.

It was stated by the chairman of the London Underground Electric Railways Company at the annual meeting that the decrease of £27,380 in the income was practically equal to the reduction in the dividend of the Associated Equipment Company, the return from the transportation companies being practically the same as for the previous year. The improvements and extensions to the factory of the Equipment Company should, he added, materially increase the output of that company in the current and future years.

L.G.O. COMPANY'S WAR CLAIM.

The Defence of the Realm Losses Commission on March 1 reserved their decision in the claim made against the War Office by the London General Omnibus Company in respect of two garages requisitioned by the military in July, 1916. At the time possession was taken the company agreed to let the garage at £850 per annum. A portion of it had also been let to the Belgian Government before the military occupation. As to the other garage, £45 5s. 8d. was claimed as the cost of removing the omnibuses and an annual rent of £325.

The claimants' solicitor stated that it was possible that an enormous claim would be made in addition, as the Government had taken about 1,350 of their omnibuses, and the company had placed their works at the disposal of the Government.

ECONOMY OF MUNICIPAL MOTORS.

Brighton Corporation are obtaining two motor vehicles for street watering and general haulage at a cost of £2,020. One will be a 3½-ton battery chassis and the other a 5-ton steam wagon. Each will have interchangeable bodies. It is also proposed to use them for ash collection in certain places where arrangements can be made for quick loading. The Corporation's decision was arrived at after considering a report presented by the surveyor and the chairman of the Works Committee upon the result of their visits to a number of towns where such vehicles are in use. It is estimated that the cost per day (including depreciation, maintenance, and interest) of the steam wagon will be £1 3s. 8d., and of the electric vehicle £1 7s. 7d. The present cost for horse and driver is 11s. 4½d., and it is said that the two machines will do the work of six horse vehicles.

The following tenders have been received for the supply and delivery at Brighton of the two vehicles :—

Steam motor wagon, rubber tires, capable of carrying 5 tons and drawing 3-ton trailer if required, with automatic tipping gear, convertible body for haulage, and 1,000-gallon watering tank with front delivery :—Alley and MacLellan, Limited, Sentinel Works, Shrewsbury (recommended for acceptance), £940 ; Aveling and Porter, Limited, Rochester, £890 ; Yorkshire Commercial Motor Company, Leeds, £885 ; Fodens, Limited, Sandbach, £850 ; Mann's Patent Steam Cart and Wagon Company, Limited, £827 ; Clayton and Shuttleworth, Limited, £815.

Electric motor wagon, rubber tires, capable of carrying 3½ tons, with electric tipping gear, convertible body for haulage, and 750-gallon watering tank with front delivery :—Mossay and Company, Limited, Westminster, S.W. (recommended for acceptance), £1,080 ; Electromobile (Leeds), Limited, Leeds, £1,152 ; General Vehicle Company, Limited, London, W.C., £1,350 ; Edison Accumulators, Limited, London, £1,420.

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MOTOR TRAFFIC.

OMNIBUSES WEAR AND TEAR ALLOWANCES.

The following circular has been issued by the Board of Inland Revenue to surveyors of taxes :—

"The Board have recently been approached by representatives of the Tramways and Light Railways Association and other similar associations with a view to an agreement as to the proper allowances to be granted in respect of the wear and tear of motor omnibuses. As the result of negotiations which have taken place the Board have agreed to the following proposals, subject to the approval of the District Commissioners :—(*a*) That the allowance for the four years commencing with 1916-17, in addition to any appeals at present outstanding for prior years, be 20 per cent. on the written down value. (*b*) That at the end of the said period the rate be reconsidered. (*c*) That as regards excess profits duty cases, inasmuch as the rate is intended to be regarded as a special rate necessitated by the war, it be applied to all accounting periods where claimed. It should be noted that where more than 20 per cent. is already allowed, the reduced rate is to be applied. These proposals do not apply to commercial motor vehicles."

FORD FACTORY FOR IRELAND.

GOVERNMENT OFFER TO BRITISH FIRMS.

In the House of Commons, Mr. Kellaway, of the Ministry of Munitions, answering an inquiry by Colonel Gretton as to whether the erection of a factory for the production of motor tractors at Cork by the Henry Ford Company of America had been sanctioned, said :—A licence has been issued to Messrs. Ford subject to the condition that they are to confine their manufactures during the war to agricultural machinery, and that they should import their own plant and material, except so far as sanctioned by the Minister of Munitions, and also comply with the directions of the latter as to conditions of employment and rates of wages. The whole matter was carefully considered by the Government, and it was decided that it was desirable to issue this licence in view of the urgent necessity for ample provisions of agricultural tractors for use in the United Kingdom in the immediate future. In order that British industry may not be placed at a disadvantage thereby, negotiations have been opened with British firms in the hope that they will act together, and if suitable arrangements for the organisation of a similar factory in this country can be arranged the Government will afford all possible facilities.

MOTOR VEHICLES FOR MUNICIPALITIES.

FOLKESTONE COUNCIL are purchasing three steam tractors at an estimated cost of £2,500.

GLASGOW TRAMWAYS COMMITTEE have obtained tenders for an electrically propelled road vehicle.

BOOTLE COUNCIL have ordered two 5-ton tipping wagons of the General Vehicle Company's manufacture.

POPLAR BOROUGH COUNCIL have accepted a tender for a Bessemer petrol wagon for the electricity department, at £745.

MANCHESTER ELECTRICITY COMMITTEE have placed a contract for the supply of a General Vehicle 5-ton electric tipping wagon.

BRADFORD CORPORATION have placed a repeat order for two 5-ton General Vehicle Company's electric wagons fitted with tipping apparatus, for the electricity department.

WIGAN TRAMWAYS COMMITTEE have received the sanction of the Council to purchase a motor tower wagon. The manager has been in negotiation for the chassis of a certain maker, but the Ministry of Munitions have refused to allow it to be supplied.

SHEFFIELD CITY COUNCIL have ordered a 5-ton steam tipping wagon, with rubber tires, from Fodens, Limited, Sandbach, a similar vehicle from the Yorkshire Commercial Motor Company, and a 2-2½ ton Orwell electric lorry from Ransomes, Sims and Jefferies, Limited.

MARYLEBONE BOROUGH COUNCIL have been recommended by a committee to accept the tender of the Austin Motor Company, Limited, of Longbridge Works, Northfield, Birmingham, and 479-483, Oxford Street, W., to supply six motor lorries. The price was given as £745 each. The council propose to use the vehicles for dust collection.

THE SHREWSBURY AND CHALLINER TYRE COMPANY, LTD., Ardwick Green, Manchester, are the successful tenderers for the supply of tires for the Manchester Corporation's motor omnibuses, motor tower wagons and horse wagons for the twelve months ending March 31, 1918.

MOTOR TRAFFIC NOTES.

NEW LONDON OMNIBUS GARAGE.—Bromley Council have approved of the plans submitted by the London General Omnibus Company for the erection of a garage to accommodate the numerous vehicles now required in that distant southern suburb owing to the growth of omnibus traffic. In the metropolitan area the company have 25 garages, the majority having been built during the past ten years.

OMNIBUS DRIVERS AND MILITARY SERVICE.—Tribunals throughout the country have responded to the requests of the military representative to cancel the exemption of motor omnibus drivers under 31 years of age who are passed for general service. Thos. Tilling and Company, Limited, who now control the entire omnibus service at Brighton and Hove, have been granted three months' exemption for all drivers between 31 and 35, with leave to apply again.

CHARGING ACCUMULATORS FOR MOTOR PLOUGHS.—For the purpose of providing light for the ploughing which is being carried on at night by motor tractors, the Government are sending out electric lighting sets worked from accumulators. If necessary the organisers fall back on acetylene lighting, but as calcium carbide is scarce and dear, reliance is placed upon local facilities for charging accumulators. The Board of Agriculture call upon all who can help in this way to do what they can. The call will be willingly responded to by managers of stations within reach of cultivated districts.

WOOD PAVING PROSPECTS.—In his address from the chair at the 45th ordinary meeting of the Improved Wood Pavement Company, Limited, Mr. J. McKerr observed that up to the commencement of the war their system of wood pavement had been making rapid strides, and ousting other forms of paving. In the present critical times there was neither labour nor money to spare for improvements, and only the most urgent cases of renewal or repair could be done. When industry resumed its normal conditions there would not only be a large amount of renewals, but there would be large areas converted to a wood surface, in order to withstand the wear of motor traffic.

DEPRECIATION OF MOTOR VEHICLES.—In his remarks at the annual meeting of the Bristol Tramways and Carriage Company the chairman (Mr. S. White) stated that with regard to the depreciation of motor vehicles and plant, they had deemed it advisable to make more provision than would be necessary in an ordinary year, as at the present time, owing to the shortage of labour and the difficulty of obtaining spare parts, it was impossible to maintain their motor vehicles an l plant at their usual standard. In the revenue account there was an item of £2,819, representing the loss on a sale of carriages and harness. The horse carriage business became each year of less importance, and last year it was necessary to dispose of obsolete carriages and harness.

PROGRESS OF THE ELECTRIC VEHICLE.—American newspapers report that a new model of an electric passenger vehicle recently ran from Columbus Circle, New York City, to the Hotel Taft, New Haven, Connecticut, a distance of 88·2 miles. The vehicle carried three passengers, and the route was over an extremely hilly district, but the journey was accomplished in 3 hours 45 minutes, including all stops and delays, and on a single charge of the battery. While the speed of about 23 miles an hour would not attract much attention, the fact that the speed was maintained over rough roads indicates that the electric vehicle has a very wide field of usefulness. Other long runs with electric vehicles have recently been reported from America, among them one from Chicago to Milwaukee, a distance of just over 100 miles.

ENTERTAINMENT OF WOUNDED SOLDIERS AT KARRIER WORKS.—On March 21 the Karrier Motor Division of the St. John Ambulance Brigade, at Huddersfield, gave a tea and concert to 171 wounded soldiers from the war hospitals at Bradley, Meltham, Crosland Moor and Royds Hall. Men of the R.A.M.C. and the St. John Ambulance were in attendance to assist certain of the guests who had been badly disabled. The guests sat down to a sumptuous tea prepared in the men's dining hall. After tea, a well-thought-out smoking concert was given in the women's dining hall, which had been somewhat altered for the purpose, and accommodation provided for close on 200 guests. Many of the Karrier works staff were present. A most enjoyable programme was gone through, all the performers, with three exceptions, being employees of Messrs. Clayton and Company's Karrier motor works. The success of the proceedings was indicated in the few remarks offered by one of the guests in proposing a vote of thanks to the hosts. The proposer expressed the hope that the officers and men of the Karrier Division had received as much pleasure in the giving of the tea and concert as the soldiers had had in receiving such kind hospitality. Hearty cheers greeted the observation.

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THE Tramway & Railway World
WITH MOTOR TRAFFIC SECTION

Founded 1892. LONDON, MAY 10, 1917. VOL. XLI.

A NEW TYPE OF CAR AT SOUTHAMPTON.

These days of scarcity of labour, of short supplies, and of high prices for materials are not favourable for carrying out on any considerable scale new ideas as to tramway plant or equipment. The very peculiarity of present circumstances, however, sometimes gives managers and engineers an opportunity for preparations for the great advances and heavy work which must come at a bound when peace is restored; and where practicable it is good policy to carry out any necessary experimental work now, so that "full speed ahead" may be the motto when the desired time comes. This course is being followed in some instances

A New Type of Car at Southampton.

thinking out new devices or improved designs which they hope to develop after the war. Several instances of such commendable foresight have come under our notice, and we make no doubt that many other innovations of which nothing has yet been heard are being worked out. It is, of course, a plain duty as far as possible to take time by the forelock and to make in connection with modified types of cars, and a good example is to be found in what has been done by Mr. W. T. Robson, general manager and engineer of Southampton Corporation Tramways.

As was shown by his paper read before the eighth annual conference of the Tramways and Light Railways Association, held in London on June 30 last year,

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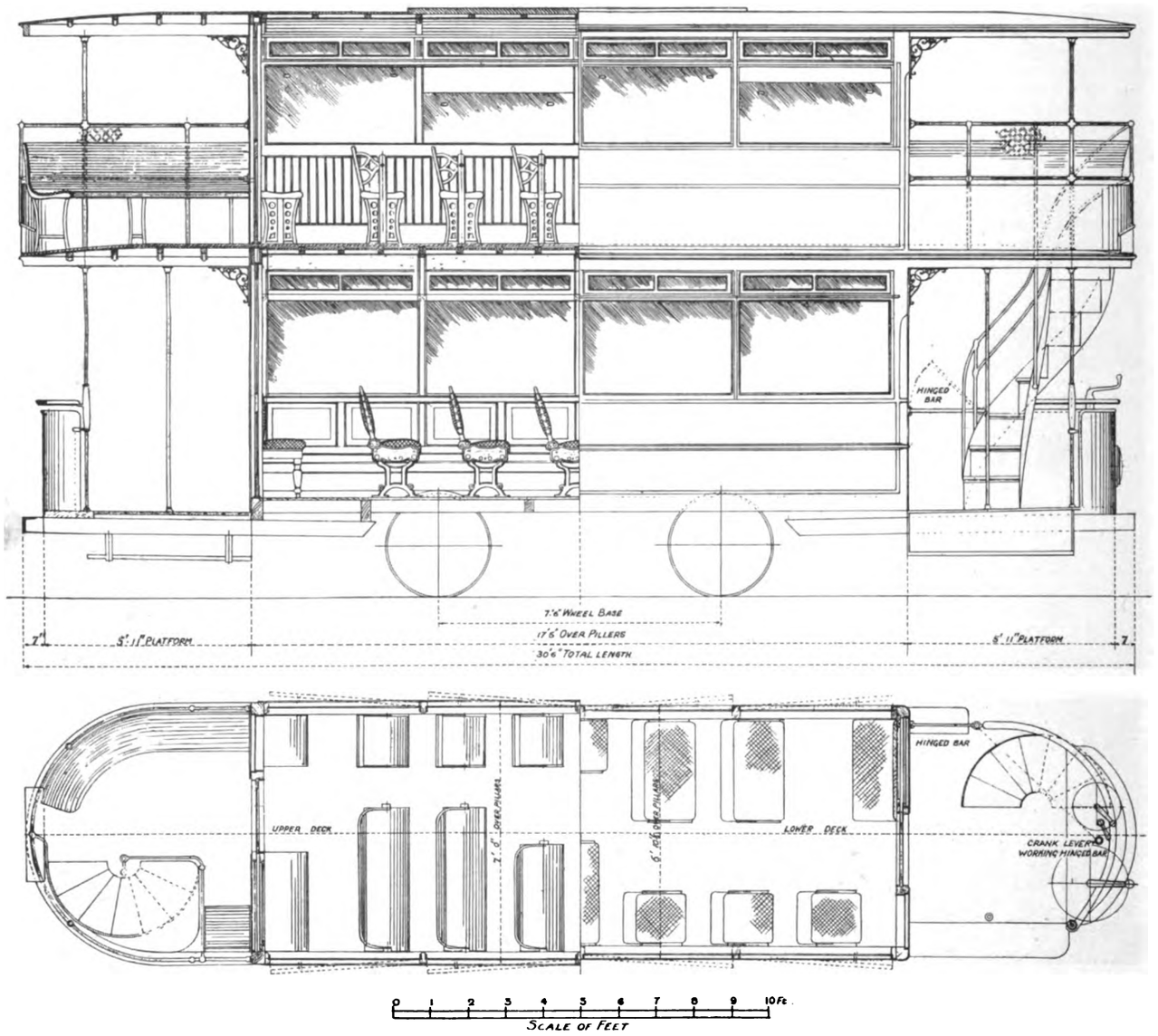
Mr. Robson has for some time been devoting his attention especially to the comfort of the passengers. Every manager, of course, must have that factor in his mind, but Mr. Robson departed from the usual practice in technical papers by discussing many tramway questions solely in their bearing on that matter. In the paper referred to (published in our issue of July 13 last) he dealt with the track, rail cleaning, trucks, brakes, seating, ventilation, exits, interior finish, top covers, and other matters—all from the point of view of how they affect the passenger. That much-sought-after individual is to be attracted by no change in type has been adopted, and that radical improvements are called for. As to seating, he expressed surprise that the use of cross seats in the lower saloon has not become more common. The advantage of being able to tell at a glance how many seats are vacant is obvious, and there need be no sacrifice of capacity as compared with longitudinal seats. It is more pleasant to face the way the car is travelling, and the uncomfortable situation which exists when a passenger is obliged to sit immediately opposite someone whom he dislikes intensely is rendered agreeably impossible. He warmly recommended the cross seat to those



Plan and Elevation of New Type of Car at Southampton.

more and more convenient arrangements. Efficient services were not left unconsidered, but Mr. Robson paid more attention to the car than to any other single item. He had many suggestions which taken together approach his ideal car, and as far as circumstances have permitted they are embodied in the new car which he has now completed. As the car will be the precursor of other improved vehicles in Southampton when peace conditions return, it will be useful to consider some of the points raised by his paper, and the extent to which they have been applied.

In regard to trucks and hand brakes, Mr. Robson pointed out in his paper that for many years practically considering the question of new rolling stock. He also advocated rattan spring seating in place of the hard wood which communicates every jolt direct to the passenger. He considered that ventilators should be fixed, and not subject to the whim of any passenger; they should open outward on a quadrant in the direction in which the car is travelling. In old cars which have no ventilator windows a good plan is to insert wire gauze at the top of the door window, or induced draught from a fan might be employed. He also pointed out the great advantages of adopting a near-side exit on the front platform. With respect to interior finish, he recommended the contrast provided

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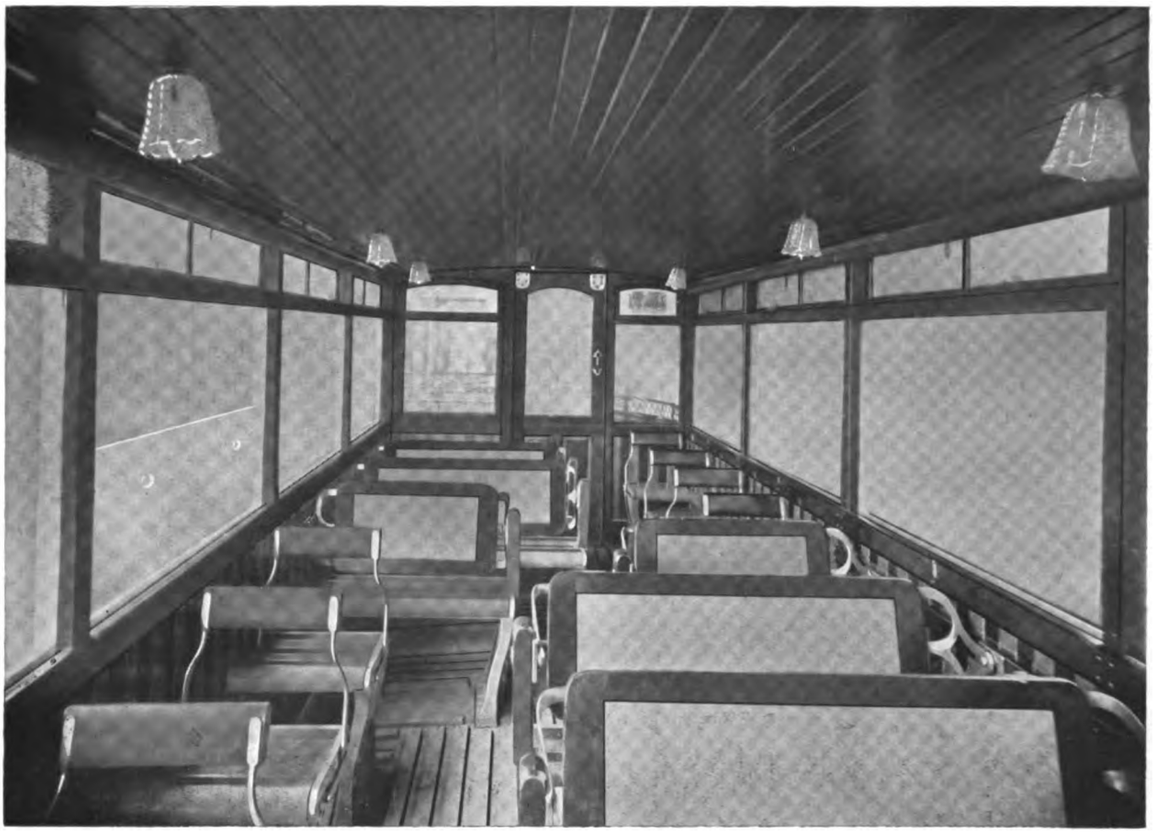
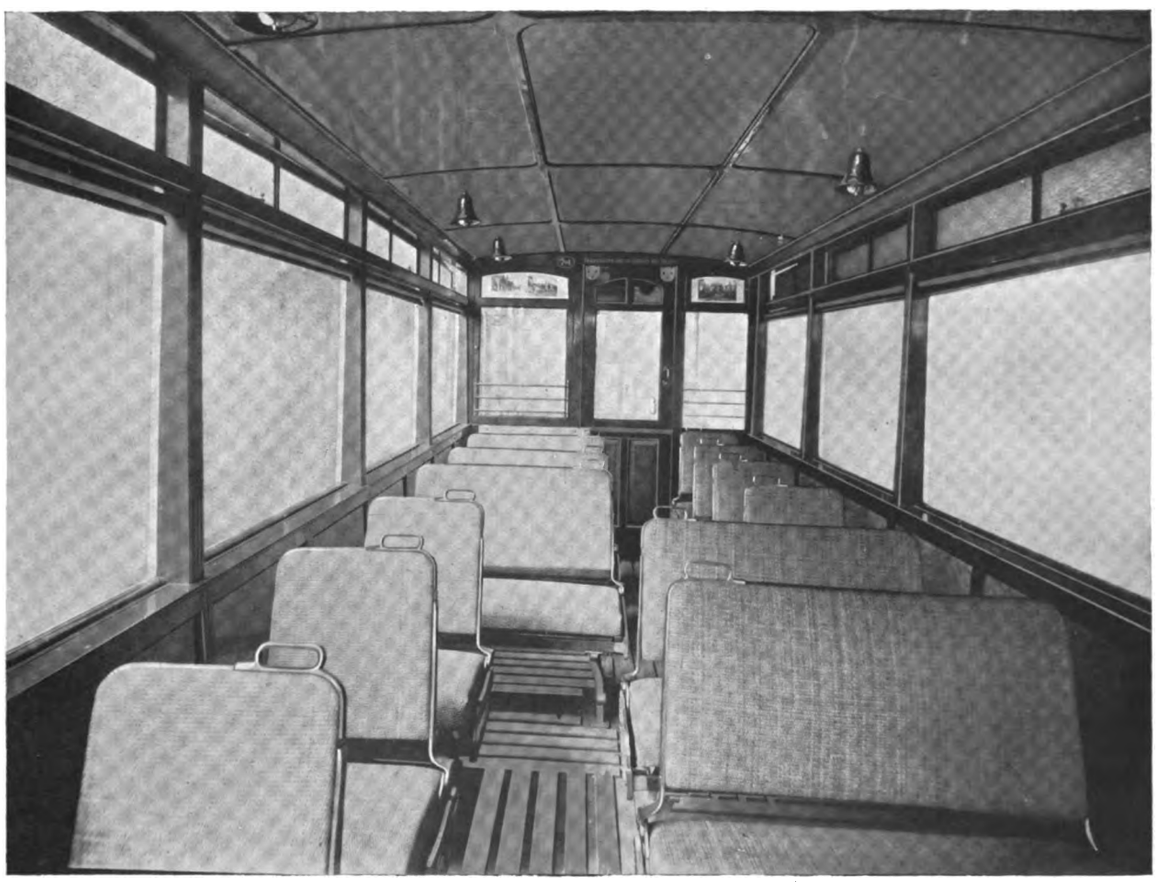


Interior of Upper Saloon.



Interior of Lower Saloon.
Arrangement of Seats in Southampton Car.

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by oak and mahogany. Corners should be rounded, and ornamental mouldings and dust traps avoided. The interior of the upper saloon should be made as attractive as that of the lower; an interior finish of alternate light and dark matchboard, with sashless lazy-tongs windows and tip-up seats, with a row of ventilator windows to match those in the lower saloon would give a wholesome, attractive effect. The seating should be improved; the outside canopy seats especially are often uncomfortable, as they have no other back than the iron rail.

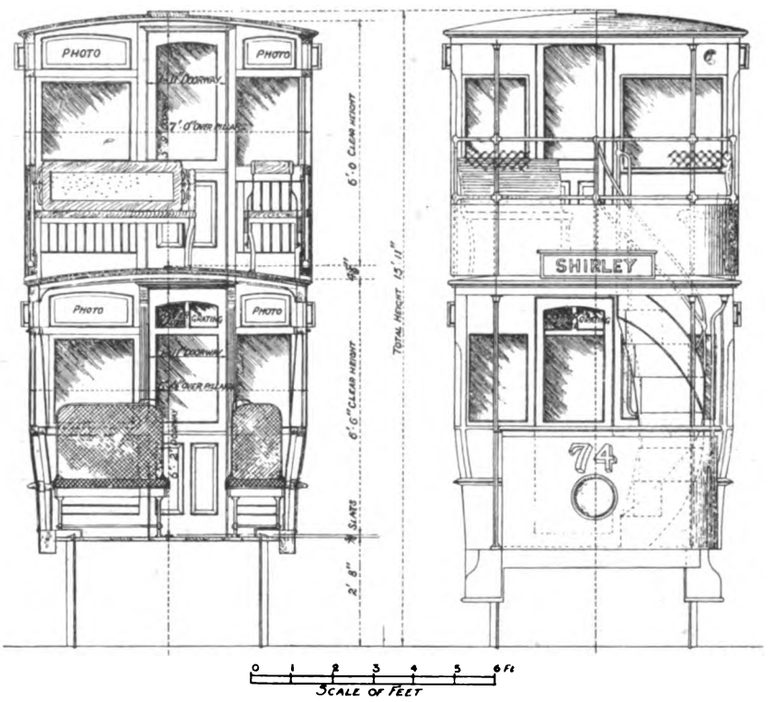
Coming to the present experimental car, the time is opportune for improvements at Southampton, as the cost of a large number of the existing cars has just been cleared off by the sinking fund. When normal times return many of these old cars will probably be replaced; and the present experiment was made with a view to determining the type most suitable for Southampton. After the car has been running for some time it will be possible to determine whether any modification in design would be desirable for the cars which are to follow. It will be seen from the following description, and also from the illustrations, that the present car conforms in many respects to the ideas set out in Mr. Robson's paper before the Tramways and Light Railways Association.

The car is of the four-wheeled double-deck type, with roof cover and open canopies. The front platform near side exit is embodied in the design, the staircase being so arranged that passengers can make use of the exit. It is closed when required by a hinged bar. The photographic views of the two saloons show that the cross seats have been employed in both. Though the Southampton tramways are of standard gauge, the seats are arranged to accommodate only three passengers abreast—two on one side of the gangway and one on the other. In this way more roomy seats and a wider gangway are obtained than if every seat were made for two passengers. The Southampton traffic includes a large number of what may be called residential passengers, and therefore this arrangement is of considerable importance. The canopy seat is something of a novelty; it consists entirely of cane, curved to the same radius as the canopy rails, and so shaped as to be thoroughly comfortable. An experiment has been made on the floor canopy with marbolith composition, which has proved very successful, as it is cleaner and more pleasant to walk on than the usual laths. There is throughout an entire absence of ornamental mouldings and dust traps, so that cleaning is easy.

The seating capacity is as follows:—Lower saloon, 21; upper, 28; on canopies, 10; total, 59. The leading dimensions are:—

Length over all	30 ft. 6 in.
Length over pillars	17 ft. 6 in.
Length of platforms	5 ft. 11 in.
Wheel-base	7 ft. 6 in.
Width over pillars, lower deck ...	6 ft. 10½ in.
Width over pillars, upper deck ...	7 ft.
Height of sill from ground	2 ft. 8 in.
Height inside lower saloon	6 ft. 6 in.
Height inside upper saloon	6 ft.
Total height above rails	15 ft. 11 in.
Width of doors	1 ft. 11 in.

The following are some details as to body construction. The floor framing is of oak. The platform floors are supported on steel angle bars, to which are secured ash end-bars. The floor is of ⅞ in. red pine boards, with 2½ in. oak wearing slats. The body framing is of teak, oak, and pitch pine, and the panels above and below the fender rail are of mahogany. The roof frame is of ash stiffened with steel. Three-ply maple veneer is used for the ceiling, with a light inner roof above of canary whitewood ½ in. thick, covered with cotton duck. The upper deck is of ⅞ in. pitch pine boards laid on ash bearings. The small ventilating sashes above the windows open outwards on a quadrant. Wire gauze gratings are fitted in the small panels of the doors. The interior finish is in mahogany framing. Ceiling joints are covered by plain rounded mouldings and a plain hollow cornice above the windows finishes the ceiling. The panels under the windows are of bird's-eye maple with mahogany framing. Over each end window is a glazed frame for holding photographic views. The rattan seating was supplied by the General Seating Company, London.



End Elevations of Southampton Car.

In regard to the upper saloon arrangements, the pillars, longitudinal rails, and end framing of the top cover are of teak. The side panels are of mahogany ½ in. thick, and here also the joints are covered by moulds. Below the windows is the dado cased with alternate matchboards of errol and pitch pine. The windows are mounted on lazy-tongs balancing gear, and the ventilation sashes are similar to those in the lower saloon. Ash roof ribs strengthened with steel are employed, and are boarded outside with ⅞ in. pitch pine boards. The inside boarding consists of narrow matching of Sequoi and pitch pine. The end panels are of teak, and here photograph frames are also provided. Errol wood and pitch pine slats are used for the seats, and the backs are framed with maple veneer panels. The curved canopy seats have already been alluded to.

The whole car is a workmanlike job, and it will be interesting to learn how far the local public, in the opinion of Mr. Robson, will appreciate the innovations.

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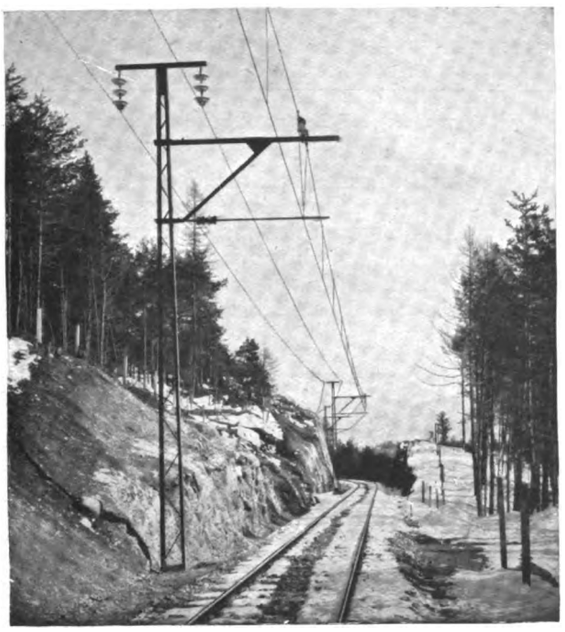
THE MITTENWALD RAILWAY.

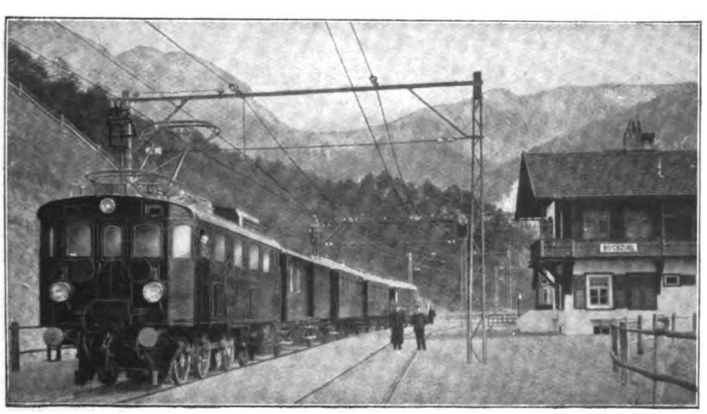
The Mittenwald Railway is a striking example of the adaptability of electric traction to the most difficult conditions. The total length of the railway is 65 miles. Beginning at Innsbruck, on the River Inn, it continues in Austrian territory to Scharnitz (21 miles). There it crosses the frontier and enters Bavaria at Griessen (25 miles). On re-entering Austria, and following a north-easterly direction, it reaches Reutte, 19 miles from Griessen. From Innsbruck to Reutte, respectively the eastern and western termini, the route is in a district grandly Alpine in character. There is perhaps no other section of a railway of equal length which contains more engineering constructional works. In a distance of 38 miles there are no less than 18 tunnels, with a total length of 2·7 miles. One alone is 1,959 yards long, and there are in addition bridges, viaducts, and numerous similar works. The more important of these works include the Inn bridge, which consists of two arches each of 165 ft. span, a masonry viaduct 950 ft. in length, and a Schlossbach bridge over a ravine 170 ft. wide. The difficulties of the situation rendered heavy gradients unavoidable, and the engineers decided that unless the length of the railway was to be unduly increased a gradient of 3·64 per cent. must be permitted. Steam in these circumstances was out of the question, and electric traction afforded the only economical solution of the problem. An abundance of water-power was an influential factor in the decision. A power station was built about four miles south of Innsbruck, and here there is a fall of 340 ft.

Electric Train on Mittenwald Railway.



Lattice Poles Carrying Transmission and Contact Lines.

Lattice Pole Carrying 50,000-Volt Transmission Line.



A Typical Station on the Mittenwald Railway.

The original equipment consisted of two 4,000-H.P. Voith Pelton turbines coupled direct to single phase generators capable of a continuous output of 3,000 K.V.A. The generators run at 300 revolutions per minute, conditional upon the character of the waterfall, have six poles, and a periodicity of 15 cycles per second. This entailed a somewhat higher cost as compared with the four-pole type, but enabled the pole cores to be fixed rigidly to the rotor hub. Some idea of the forces coming into play can be gathered from the statement that a wound pole shoe weighs 3½ tons, and with the fixing arrangement on the rotor hub is subjected at a normal speed to a centrifugal force of 343 tons. The generators are wound for a pressure of 3,000 volts, and the current is led to transformers by which the pressure is raised to 50,000 volts. Each generator and transformer unit forms an inseparable couple, so that no busbars or switches are provided

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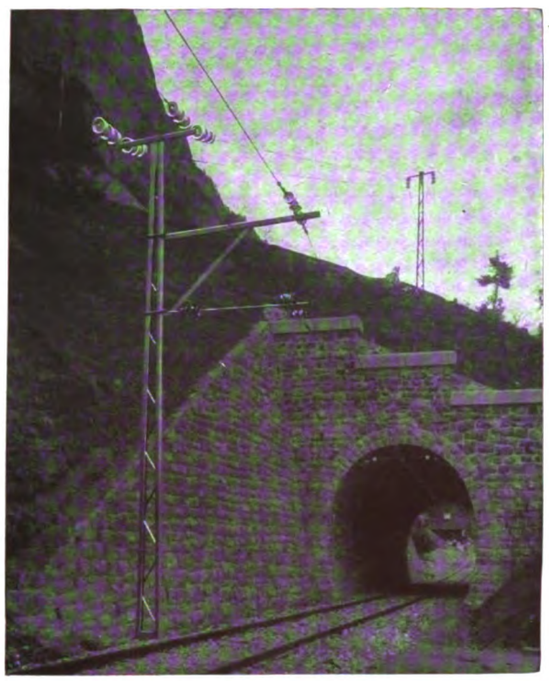
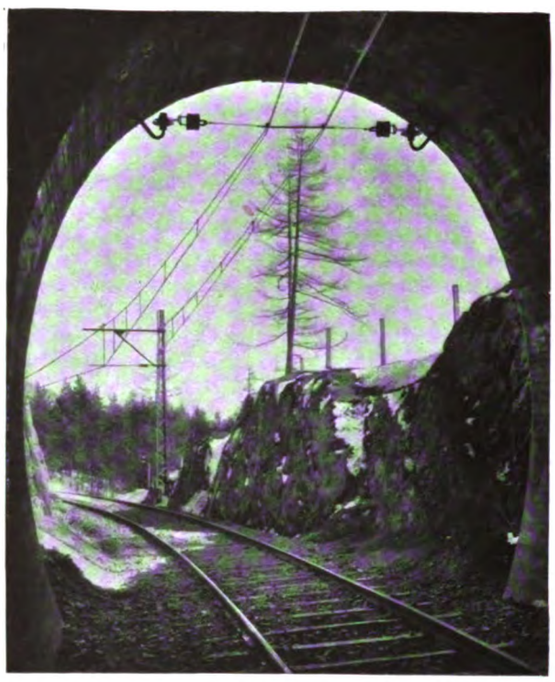
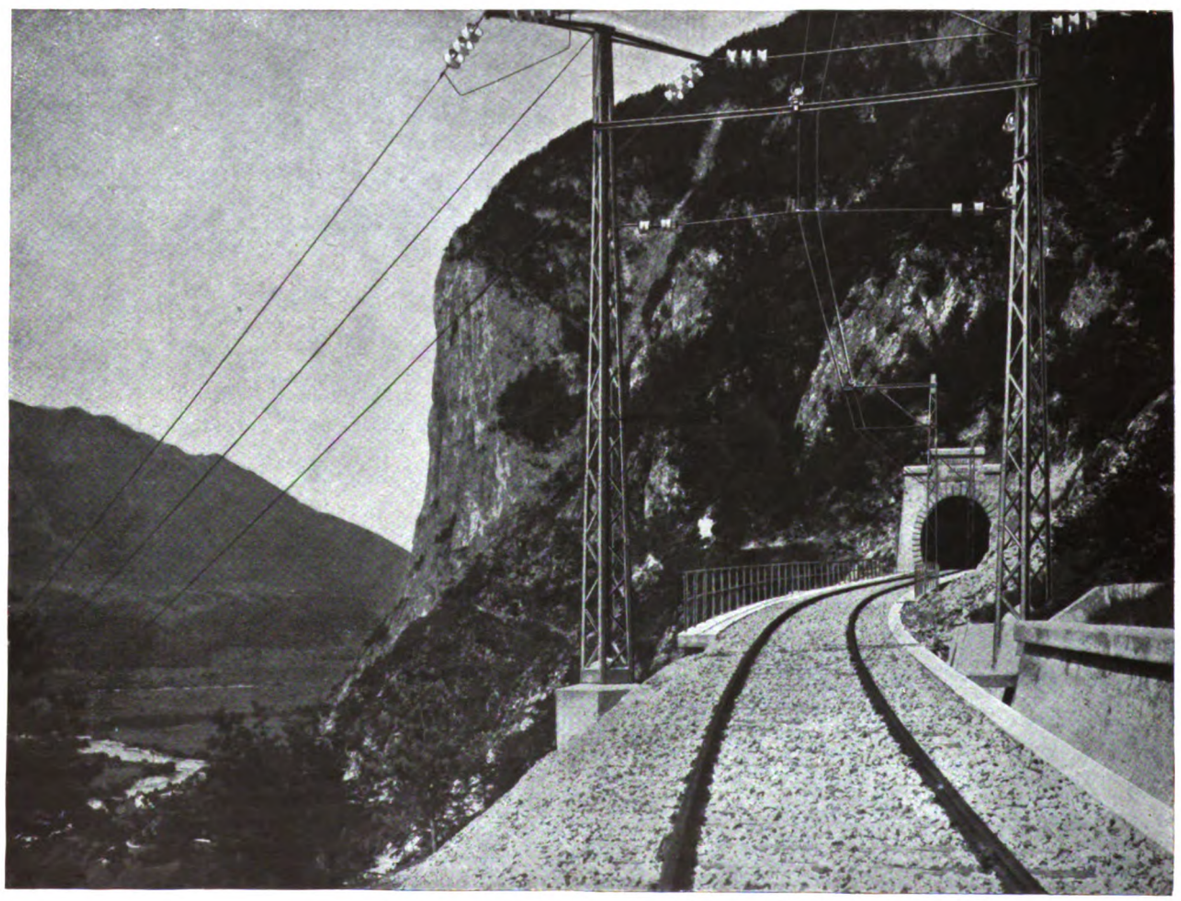


Transmission Line Carried Overground at a Tunnel on Separate Poles.



Suspension of Control Lines in Tunnel.

for 3,000 volts, all switches being placed only on the 50,000 volt side. The transformers are oil and water cooled, and are of the core type with disc windings, the wound core weighing 23 tons. The transformers are separately erected in fireproof cells. Each apparatus placed under a pressure of 50,000 volts is mounted separately in a cement cell, the ground plan being arranged so that in case of a breakdown the switchgear room may be entered from two sides without danger. All the switches have electro-magnetic remote control operated from the switchboard in the machine room. They are operated with automatic overload releases. The latter can be adjusted for a time limit, and are also arranged for hand operation.



Approach to a Tunnel on the Mittenwald.

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Sub-stations are situated at Reith, about 12 miles from the eastern, and at Chanz, about two miles from the western boundary of Austria. The transmission line is carried principally on lattice poles, which also support the overhead contact line. As a protection against atmospheric discharges a copper lightning wire is mounted upon the high-tension line at the top of the poles, and is earthed to the depth of the ground water at each pole. The lattice poles are placed 240 ft. apart, and the line is so constructed that every fifth pole will stand firmly even if the line breaks on one side. The intermediate poles are flexible. On the Innsbruck-Scharnitz section, a distance of about five miles, the transmission line is carried on a special row of poles, as the numerous tunnels on this section made it impracticable to erect the transmission wire on the trolley wire supports.

The transmission pressure of 50,000 volts requires, of course, very careful insulation, and a special type of link suspension was designed for the installation. The type was specially constructed for anchoring the contact line, which weighs only 6 lb. per insulator, and possesses a breaking strain of 17,000 lb. These insulators gave a test voltage in a dry condition of 50,000 volts. The grooves on the insulators are of round section, and for fixing steel bands are used which lie with their entire surface flat on the porcelain and do not injure the glass. The grooves were filled up to prevent the penetration of water and freezing. The insulators are provided with jointed fittings which take up all movement.

The catenary suspension is arranged without automatic tightening devices, as the continuous series of sharp curves entail much friction, and make it impossible for the customary tightening devices to work reliably.

When the Mittenwald Railway was first opened in 1912, nine electric locomotives were provided, each having a normal rating of 800 H.P. The locomotives were designed to draw a gross weight of 124 tons on the 3·64 per cent. gradient at a speed of about 20 miles per hour, but the machines are capable of much severer service. The locomotives weigh 53 tons. They are provided with two bow collectors with sliding contacts, by which the current is taken from the overhead line. It is then led through a bare high-tension conductor carried on the roof to a lightning-arrester choking coil, and thence to the transformer compartment, where it is connected up to the high-tension oil switch. This switch breaks the circuit at four points, and an auxiliary resistance is provided in order to reduce the stress set up on switching in the transformers. The oil switch is worked directly by means of the knife switch from the front driver's cab. It can be switched out from the rear cab by means of a press button which is connected through a resistance to the controlling current coil, and is switched in by means of an operating rod. Between the lightning arrester, choking coil, and the oil switch the earthing switch is inserted, which is closed automatically as soon as the protecting cover of the oil switch is removed. From the oil switch the current passes to the primary winding of the power transformer, and flows from here through the high-tension current transformer connected in series direct to earth. The secondary winding of this transformer feeds the maximum cut-out of the oil switch and two ammeters in the driver's cab.

The traction motors have a normal rating of 800 H.P. when running at a speed of 18·5 miles per hour, and are of the twelve-pole single phase commutator type. The regulation of the motor is effected by altering the voltage of the current supplied to it, which is done by means of contactors connected up to the lappings of the power and exciter transformers, and operated by the controlled current. The latter is taken from the special coil of the power transformer at a pressure of 300 volts, and is rated through a switch and fused to the master controller.

SOME RESULTS OF HEAVY RAILWAY ELECTRIFICATION.

Two papers read before the New York Railroad Club on March 16 last are of exceptional interest as giving some of the results obtained by electric traction with trains of very great weight. The application of electricity to such services is, of course, quite recent. Descriptions of the electric equipment of the two railways dealt with have already appeared in our pages. One is the Chicago, Milwaukee and St. Paul Railway and the other the Norfolk and Western Railway. The paper in regard to the former line was by Mr. R. Beeuwkes, electrical engineer of the railway, while that relating to the Norfolk and Western was by Mr. C. H. Quinn, chief electrical engineer of the undertaking.

The Milwaukee Scheme.

Mr. Beeuwkes, in his paper, stated that the Milwaukee and St. Paul electrified section, 440 miles in length, is in two operating divisions, one of which has been in service long enough to permit the collection of reasonably reliable data. The time in question is less than a year.

Harlowton, Mont., is the eastern terminus of the Rocky Mountain division, and the station where electric operation begins. Three Forks separates the division into east and west sub-divisions. Deer Lodge is the western terminus of the Rocky Mountain division. With the introduction of electricity the engineers were able to double the cruising radius of the locomotives. All locomotives run the entire 226 miles from Deer Lodge to Harlowton with only a very light inspection at Three Forks for bearings and pantagraphs.

Power consumption has been found on a typical day to vary from a maximum of 20,000 KW. to a minimum of less than zero at times when regenerative braking is taking place to a sufficient extent to supply all the railway demands and actually return some energy to the power company's supply system. How much this is is not known, as the curve-drawing meters do not register negative kilowatts. Under present conditions they are running with a monthly load factor—ratio average load to maximum load—of about 40 per cent., but expect within a few months to have installed a so-called power indicating and limiting system, which will automatically indicate to the dispatcher the exact amount of power which the whole system is drawing at any instant, and will automatically within certain limits hold the maximum down to a certain predetermined amount. This has the object of keeping as low as possible the maximum amount of power for which the railway company have to contract with the power company.

A comparison of passenger train delays for October, November, and December under steam operation in 1915, and electric operation in 1916, indicates the comparative reliability of service under the two systems. The passenger service consists regularly of two through, heavy, steel, eight-car trains each way per day, and one three-car local each way between Butte and Harlowton. The schedule time of the through trains under electricity is 40 minutes less than was that of the steam trains.

The records show a great decrease in operating delays. The dispatcher is better able to plan and predict train movements. This may be accounted for

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on the basis of less varying speed, lower number of freight trains for a given business, and fewer trains delayed. In the three corresponding months steam passenger trains waited for the right of way 1,910 minutes, as against 254 minutes for electric trains. Delays on account of extra heavy trains were only one-ninth as great under electricity as under steam. The electric engines handle ten or eleven steel cars on the 2 per cent. Piedmont gradient very comfortably.

In places the temperature is some times 50 deg. below zero for days at a stretch. It might have been expected that such low temperatures would result in many trolley and transmission troubles due to contraction of wires and cables, but the construction is particularly suited to such conditions, and they now have but little trouble on this account. The records for the three months in question show 445 minutes' delay to passenger steam engines and none to electric engines.

Electric engine failures have caused more delay than steam engine failures. There has been more trouble with electric motor bearings than the engineers expect to have ultimately, as there has been some difficulty in obtaining proper lubricant, and the packers have had to acquire new experience in handling the high-speed bearings involved. However, on account of regenerative braking there has been a marked reduction in waits to repair brake rigging and to change shoes.

Of the electrical troubles, exclusive of those on the locomotive, most are due to the pantagraph fouling the overhead construction, either because of the trolley wires or the track getting out of alignment or one track rail being low. Failure of power is practically negligible. The minutes of delay attributable to the electric system, outside of the locomotives, amount to about 8 per cent. The total minutes of delay is about the same for the two systems, but the number of trains delayed is reduced about 40 per cent. under electricity. Delays due to electrical features of the locomotives are comparatively slight, a rather surprising and gratifying fact considering the number of new features, such as the use of 3,000-volt direct current and direct-current regeneration, and that only a year ago the men operating these locomotives were all driving steam engines. The double trolley wire construction used has proved very successful, absolutely sparkless collection of current being obtained in all conditions of speed and amount of current. Twenty-six per cent. of the total minutes of delay was attributable to the electric system as a whole.

The accompanying table shows a comparison of locomotive performance for October, November, and December, under steam operation in 1915, and electric operation in 1916 :—

	Steam.	Electricity.
Passenger Service.		
Train or train engine-miles	119,330	119,237
Helper engine-miles	24,752	—
Number engines	13	7
Train-miles per engine	9,190	17,040
1,000 kw. hrs. at power company's meters	—	34,785
Kw.-hrs. per train-mile	—	29·1
Coal, total tons	11,260	—
Coal, lb. per train-mile	188	—
Freight Service.		
1,000 ton-miles	282,862	364,087
Train-miles	176,937	186,010
Helper engine-miles	56,363	20,157
Number engines	43	15
1,000 ton-miles per engine	6,745	24,260
Number trains	792	855
Ton-miles per train-mile	1,600	1,960
Total time, hours	17,825	14,535
Minutes per 1,000 ton-miles	3·78	2·39
1,000 kw. hours at power company's meters	—	14,343
Kw. hours per 1,000 ton-miles	—	39·4
Coal, total tons	39,050	—
Coal, lb. per 1,000 ton-miles	276	—

The number of passenger electric engines can probably be reduced when train heating apparatus is got into shape and minor electrical improvements completed. The number of steam engines on the other hand is a minimum. The electric freight engine handles about 3½ times as many ton-miles per month as the steam engine. The electric engine cuts 30 per cent. from the time to do a given business, partly by faster running and partly by heavier trains The tonnage of through freight trains is greater than is indicated, the average figures shown being considerably reduced on account of the comparatively light local freights that are included. The cost of electricity is considerably less than the sum paid for coal.

As to the effects of regeneration on the power consumption, for the month of November the amount of regenerated power measured at the locomotives was 11·3 per cent. of the total power consumed at the motors. Tests on a 2 per cent. gradient with a passenger train have shown a return as high as 42·8 per cent. The power-saving feature of regeneration, however, is not considered so important as the increased safety and ease with which trains are handled on the heavy mountain gradients, and the saving in wear and tear on the brake shoes and equipment.

The Norfolk and Western Case.

Mr. Quinn said that with the introduction of the electric locomotive on the Norfolk and Western Railway on January 1, 1914, the increase in speed of tonnage trains from seven to fourteen miles per hour up the gradient, as well as the prompt handling of these trains through the Elkhorn tunnel, had an immediate effect on the "keying up" of the entire traffic. With the exception of two through passenger trains, any of the electrically-handled coal trains can keep out of the way of any steam movement in the same direction on the gradient. The elimination of delay represents a very considerable improvement. Further, the absence of delays incidental to the taking on of coal and water for the three steam locomotives originally required on tonnage trains has not only materially reduced the running time but has removed cause for delays to other trains.

The characteristics of the type of electric locomotive used, permitting the maintenance of a constant speed of 14 miles per hour up grade, as well as the same speed characteristics in regenerating and holding to a constant speed the trains moving down, have enabled the telegraph operators, tower men, and dispatchers to figure very closely on these tonnage movements. The shortened time element, coupled with the absence of stalled trains and the reliability of the electric service, has eliminated the single-track tunnel at the summit of the gradient as a factor governing train movement.

A result is a marked reduction in the time necessary for the crews to get over the road. Under steam operation the average miles per day was about 60 per locomotive. For the electric engines this mileage has been increased to 100, with comparatively slight increase in time in service per day for the engine crew. As a result of this, as well as the short terminal time allowed the electric locomotive, it has been practicable to reduce the number handled out of Bluefield from 17 steam engines to five electric locomotives. The number of pusher engines on the ruling gradient has been reduced from seven steam locomotives to two electric engines.

A large part of the electric zone is through a narrow valley, with resulting encroachments from buildings, coal tipples, coke ovens, and the property lines of the mining companies. About 60 per cent. of the track is on curves, and there are 54 localities for switching

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movements from the main line. Fourteen miles an hour represents the maximum safe speed at which the heavy trains can be handled through this section. With this speed the company are enabled to double the rate at which the movements were made with steam locomotives. At a constant speed of 14 miles per hour the electric locomotive does not have any difficulty in keeping out of the way of local passenger trains and time-freight trains. The 28 miles per hour speed, which is used when double-heading passenger trains, as well as when handling the freight tonnage over the lighter gradients, has likewise proved very satisfactory. Over this latter section of the road the absence of mine operations and the comparatively few points where main line switching can take place, permit of the use of a running speed of 28 miles per hour for a 3,250-ton train.

With a fixed tonnage to be handled by the locomotives, the horse-power developed per locomotive corresponds directly with the speed. With a service requiring as much as 8,000 H.P. per train for accelerating, and a continuous demand of 6,000 H.P. per train for running at 14 miles per hour, it will necessitate the transmission of an equivalent amount of energy from the sub-station to the locomotive. The running speed at 14 miles per hour has worked out with great satisfaction, and even under 28 miles per hour operation and full load the working of the pantagraph current-collecting system has been eminently satisfactory.

The following table will verify the wisdom of the railroad company in its decision to instal the electrical system. The figures for 1914 represent the last complete annual period of steam locomotive operation, and those for 1916 cover the complete electric operation for that year.

	1914.	1916.	Per cent. change, + or −
Maximum east-bound tonnage for any 24-hour day—gross tons ...	51,226 ...	59,543 ...	+16
Maximum east-bound loaded cars for any 24-hour day	675 ...	757 ...	+12
Total east-bound loaded cars for year	132,618 ...	165,689 ...	+22
Total east-bound ton-miles for year (millions)	467 ...	592 ...	+27
Maximum number of locomotives required for heaviest day	43 ...	9 ...	−79
Total locomotive-hours required for year's business	93,625 ...	44,112 ...	−53
Normal number of locomotives in service	24 ...	7 ...	−71

It is doubtful whether the increased volume of traffic shown could have been successfully handled with steam operation if only for one day of 24 hours.

In general the cost of the electrification does not exceed to any great degree the value of such physical improvement to the road-bed and right-of-way as would have been necessary to put this division of the railroad in a position to handle the additional traffic with steam locomotives. The operating cost of the electric system is well within the original estimate. The ability of the electric locomotive to stand up under the heavy and exacting duties in pusher service, requiring the use of full power to hold the train slack while at a standstill, and to handle its rated tonnage according to the specifications, is being demonstrated in every-day service. The present rating of engine, after being in use for two years, is identical with the figures quoted in the contract. The electric engine has more than met expectations in the way of giving more engine-miles per 24 hours than was expected. Generally, the electric locomotive service has not only increased the capacity of the track at least 100 per cent., with a very conspicuous reduction in operating costs, but is likewise paying a return on the net cost of the installation. The installation is an engineering, an operating, and a financial success.

LONDON TRAFFIC AND THE FUTURE.

The problem of London's future planning and its traffic facilities is essentially one that demands continuous and unremitting study, and thus the work that is being done by such institutions as the London Society in this direction has a value which, in these times, may not be so fully appreciated as might be the case. The society's purpose is to encourage discussion and consideration of London's present and future necessities, so that its inevitable changes may assuredly be changes for the better. This was the need emphasised by Mr. Paul Waterhouse in a lecture delivered to its members a few days since on "London After the War."

The first occurrence, he said, which made him recognise this need was in 1905, when the report of the Royal Commission on London traffic was issued. It was even then made clear that something serious and important ought to be done to relieve congestion, and the matter had become increasingly urgent since. Reforms were pressingly called for, but it was of the utmost importance that they should be reforms upon the right lines. Referring to the trouble of congested thoroughfares, he felt that there had been a scarcity of ideas on this subject. People were far too apt to seek relief in one way only—by widening. Widening was by no means always a remedy. If a road was troubled with overcrowding, the cause might be not only that it was of itself of inadequate capacity. It might be that it was conveying traffic to an inadequate destination. This condition created a bottle-neck, and there could be no cure for that short of elimination. Bottle-necks might take various forms, and of these the concentration of roads at centres was the most common. They no doubt looked exceedingly nice on plans, but they gave great trouble to the police in regulating traffic. Crossings of more than four roads should therefore be always avoided, and it would be well if all the more important of such crossings were made on the "over and under" principle. It would be an advantage to make such crossings, wherever possible, at open garden spaces, rather than at points closely locked in by buildings, which involved structures of some times awkward proportions. A system such as this would greatly simplify the task of traffic control, and obviate much loss of time. He further recommended that all roads should bifurcate as they approached towns. This in itself was a corrective of the tendency towards over-concentration at centres; it relieved congestion by dividing the traffic just as it might begin to be heavy, and was convenient in that it gave people a better chance of reaching their destinations by the most direct and shortest route than was the case where they were limited to one road.

He then proceeded to deal with the railway problem, more particularly in relation to the oft-discussed proposition of establishing one great central terminus to accommodate all the railways running into London, superseding the separate stations now existing. He did not favour the idea, and proposed as an alternative a scheme of setting back the termini now within a radius of about 1½ miles from St. Paul's. This, of course, would comprise Charing Cross, Cannon Street, and Holborn Viaduct, but he was strongly of the opinion that these sites could be far better utilised for other than railway purposes. He was aware of the objections to the removal of these termini from the point of view of suburban traffic, but thought they could reasonably be met. But the central terminus project, although he knew many who were in favour of it, had many too serious drawbacks to commend as a practical scheme.

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MOTOR TRAFFIC.

the country depends to re-establish itself, and to help it in repairing the economic wastage of the past thirty months. It may be politically necessary for the British motor industry to reconcile itself to a State policy of fiscal neutrality so far as overseas rivals are concerned. There is so much to be said on both sides of the controversy of protection *versus* free trade that the issue must, for some time to come, remain in doubt, and all the more so because the question is partly a political one and partly economic. British motor manufacturers therefore must be prepared in the ultimate resort to carry on without actual fiscal assistance from the State. They are, however, entitled to demand that there shall be no deliberate loading of the dice against them—that whether the country can see its way to assist them against their foreign competitors or not, it shall, at all events, refrain from giving aid of any kind, direct or indirect, to the latter. That the necessities of the war have in themselves tended towards this unfortunate result must be regarded as more or less inevitable, and though it must be counted as unfair that British motor manufacturers should have been compulsorily diverted from their ordinary activities, whilst their competitors were left unhindered, it was simply one of those things that could not be helped. Throughout the war the country has, however, been treated to the spectacle of important enterprises being turned over to work other than motor car building, and at the same time large Government purchases of American-built cars. This, again, may have been unavoidable, but it serves to emphasise the necessity for not carrying the process of discrimination against our own enterprise any farther. Indeed, to do so is not only unnecessary but positively mischievous. Unnecessary and mischievous are the only terms one can apply to the policy involved in the license granted to Mr. Henry Ford in connection with his new factory at Cork. It is true that a principal condition of this license is that nothing but agricultural tractors shall be made at this establishment until after the war. This proviso is excellent in theory—ignoring for present purposes the question of whether the agricultural tractors to be produced at this new Ford factory might not equally well be built in this country. In practice, however, the whole proposition is open to the gravest objections, and considerable weight must attach to the protest made against it on behalf of the British motor industry. In this protest it is pointed out that it is highly unlikely that any such factory as that projected can be constructed and set to work so promptly as to produce an output before the probable end of the war. Consequently it is felt that this prohibition amounts to very little. If the Government adheres to its present attitude it will be in the position of assisting the foreign competitor, and hindering home enterprise, which will find itself opposed by a factory in full working order, able to turn out large quantities of cars as soon as peace arrives. A considerable time must elapse before the British manufacturer can reorganise his resources from a war to a peace footing, and then he may find the market monopolised by a foreign maker to whom special facilities have been granted.

THE METROPOLITAN ASYLUMS BOARD have accepted the tender of the following firms for the supply of tires for motor ambulances and lorries, the guaranteed mileage of the solid tires being 10,000:—Avon Indiarubber Company, Shrewsbury and Challiner Tyre Company, Grimston Tyres Company, and the St. Helens Cable and Rubber Company.

RATIONING OF PETROL SUBSTITUTES.

Mr. H. W. Cole, secretary of the Petrol Control Committee, on March 10 issued the subjoined notice to owners of motor vehicles:—

"The restrictions which have been imposed on the use of petrol have led to a considerable increase in the consumption of petrol substitutes. The importation of these substitutes requires the use of tonnage which it is absolutely necessary to economise. The Petrol Control Committee are therefore compelled to take measures for the limitation of the consumption of petrol substitutes used in motor vehicles, and the attention of all owners and users of motor vehicles is called to the following order which is being issued to all licensed dealers in motor spirit, and will have effect as from March 10:—

"The sales of all substitutes for petrol which are sold for use in motor vehicles must be entered on the motor spirit licence held by the purchaser.

"The monthly quantity of petrol and substitutes purchased by the owner of any motor vehicle must not exceed the monthly quantity of motor spirit authorised by the Petrol Control Committee to be purchased."

FURTHER RESTRICTIONS FORESHADOWED.

In the House of Lords on March 28, Lord Hylton, answering Lord Strathspey, said owing to the increasing demands for petrol by the military authorities, the present shortage of supply was likely to be accentuated, and it would be necessary to take steps further to restrict supplies to consumers. A large quantity of petrol was consumed by motor omnibus companies, and it was proposed to reduce the supply of petrol to them by about 20 per cent. This would involve a corresponding reduction of services. Owners of cars used for purely private purposes would not receive any allowance of petrol at all after their present licences expired, and even in the case of a private car employed in public work the petrol allowance would be cut down in all probability to a maximum of 10 gallons a month, except in a few special cases where a car might be used for work in connection with the war.

In the House of Commons, on March 26, Mr. Duncan Millar asked the Prime Minister whether his attention had been directed to the number of motor cars which were used in conveying passengers to the race meeting held at Gatwick on the 21st inst., which included a number of high-powered private cars, many of which were quite new, and to the consumption of petrol on that occasion, estimated at some 2,500 gallons, and whether he would take immediate steps to prohibit the use of motor cars for race meetings at the present time.

Mr. G. H. Roberts (Parliamentary Secretary, Board of Trade) replied that it was not proposed to prohibit the use of motor cars at the very limited number of race meetings now permitted. He might say, however, that no new licences were now being issued by the Petrol Committee for the supply of petrol to private cars not used for national purposes.

THE EFFECT ON OMNIBUS FARES.

The further restriction alluded to above, combined with the decree that petrol substitutes must be reckoned in the allowance of petrol for which licences are issued, is likely to result not only in the reduction of services, but in higher fares. At Sheffield the Corporation Tramways and Motors Committee, early in March imposed an addition of 25 per cent. on the omnibus fares charged to places beyond the city boundary, and on March 23 the London General Omnibus Company curtailed a number of their services. This has drawn protests from the public, but the reductions will, it is understood, have to be extended as times goes on. Some districts are already without 'buses, and the closing of London railway stations and increase of fares accentuates the great inconvenience.

Further enforced taking off the road of omnibuses will, it is stated, inevitably result in an increase in fares. The omnibuses maintained will only carry a certain number of people, and the fewer vehicles there are the higher must be the fare charged. Care has evidently been taken to continue routes upon which hospitals for the military are situated, and those used by munition workers. The pleasure routes were the first to go. The question with reference to the omnibuses is as to whether they are performing a national service, and there can be no doubt that they are, especially in providing means of transit for so many thousands of war workers. If the restriction as to use of substitutes is not withdrawn drastic reduction of services and higher fares must ensue.

Interviewed on the subject on March 28, Mr. H. E. Blain, operating manager of the London General Omnibus Company, said:—"Although we took 15 per cent. of our omnibuses from the streets last week, I am not surprised that we have to effect a further reduction in the service. It is regrettable because the public need for

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omnibuses was never so great as it is now, when so many suburban stations are closed, railway fares have been increased, and an abnormal number of girls and women come to business from the suburbs."

REDUCTION IN LONDON OMNIBUS SERVICES.

In consequence of further restrictions in the supply of motor fuel, the London General Omnibus Company withdrew on March 30 the following routes: Kilburn and Tower Bridge, Wimbledon Park and South Hackney, Wanstead and Epping Town, Stroud Green and Putney, Teddington and Highgate, Woodford and Victoria, Clapham Common and King's Cross, Crystal Palace and Shepherd's Bush, Walham Green and Camden Town, Barnes and King's Cross, Putney and Camden Town. At the same time reductions were made in a number of other services. Further reductions in the services on other routes will be necessary as soon as they can be arranged. Certain adjustments will also be made to afford connections which the public need.

ARMY APPROPRIATION ACCOUNTS.

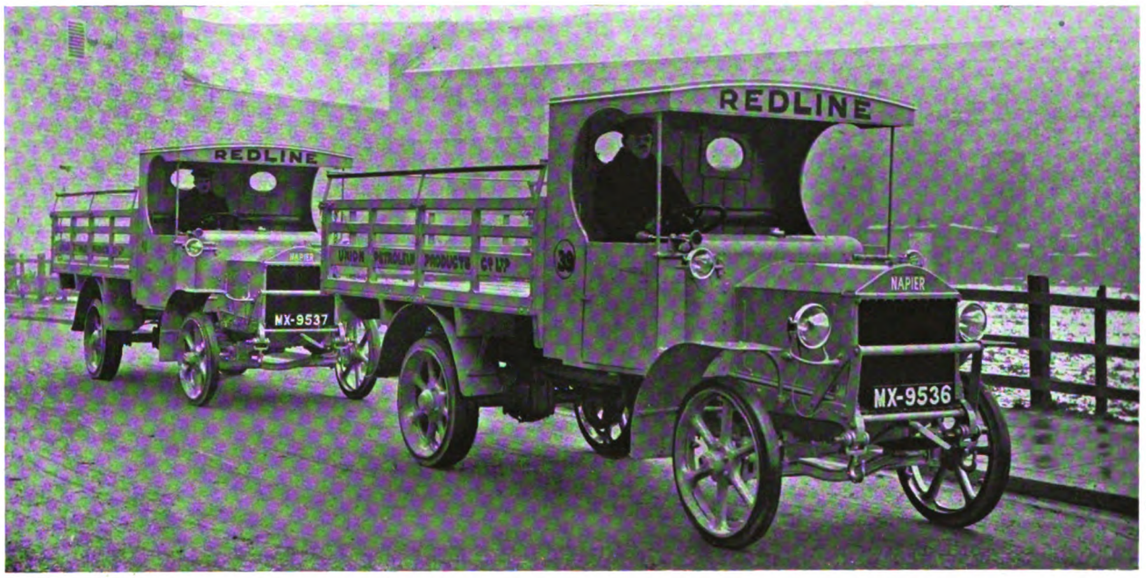
IMPRESSMENT OF OMNIBUSES—MECHANICAL TRANSPORT DRIVERS.

In the Army Appropriation Accounts for 1915-16, issued on March 26, reference is made by the auditor to the taking over of London General Omnibus Company's vehicles. No definite agreement as to compensation was made. Protracted negotiations followed, and a settlement was reached at £585,000 as against a claim of £626,873.

Another matter referred to by the auditor is the payment of a considerable sum to an omnibus company for the instruction of mechanical transport drivers who were receiving 6s. per day and had been enlisted on the understanding that they were already qualified drivers.

NAPIERS FOR PETROL DISTRIBUTION.

Through the agency of the two 30/45 cwt. motor wagons illustrated on this page, and supplied by D. Napier and Son, Limited, New Burlington Street, London, W., the Union Petroleum Products Company, Limited, London, have freed themselves from the delays now unavoidable in the railway service. The Union Petroleum Products Company, Limited, are engaged in supplying petrol to the various Government depots, and they felt the need of a reliable vehicle that could undertake this important work. Napier business vehicles can only be supplied to such firms as are doing urgent Government work, in which case release is granted.



Napiers for Petrol Distribution.

SALFORD GAS COMMITTEE have ordered a 3½-ton Sentinel steam wagon, complete with hydraulic tipping gear and rubber tires, from Messrs. Alley and MacLellan, of Shrewsbury.

THORNYCROFT AIRCRAFT GUN CHASSIS.

Since the outbreak of war, Messrs. J. T. Thornycroft and Company have supplied a number of their 40 H.P. type "J" chassis to the War Office with special stiffened frames to carry anti-aircraft guns, the guns being fitted up by the military authorities themselves.

An interesting official film has recently been taken showing the Thornycroft anti-aircraft gun chassis in action, and one of these illustrations, which has been enlarged from the War Office film, is here reproduced.

Since the supply of motor vehicles for military purposes has been taken over by the Ministry of Munitions, thus bringing arrangements for these into line with those for the supply of guns, shells, and other munitions of war, Messrs. Thornycroft have, at the instance of the Ministry of Munitions, put in hand further extensions to their Basingstove works in order, as soon as possible, to double the output of their type "J" chassis, as the experience gained with the large number of these 3-ton machines already in service has created an urgent demand for them on all fronts.

FORFARSHIRE COUNCIL are considering a report prepared by the surveyor in favour of replacing horse haulage by steam vehicles.

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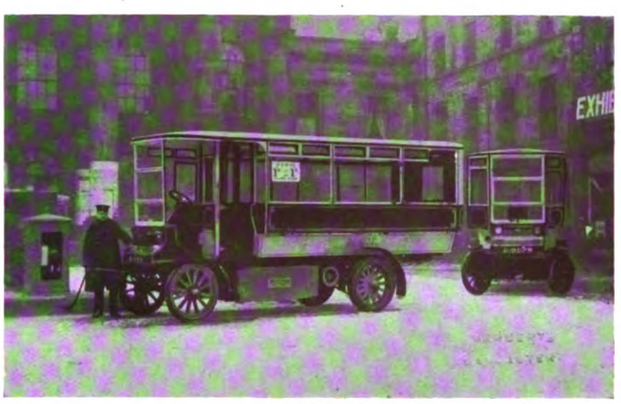
LANCASTER ELECTRIC OMNIBUSES.

PAYMENT TO THE DRIVER ON ENTRY.

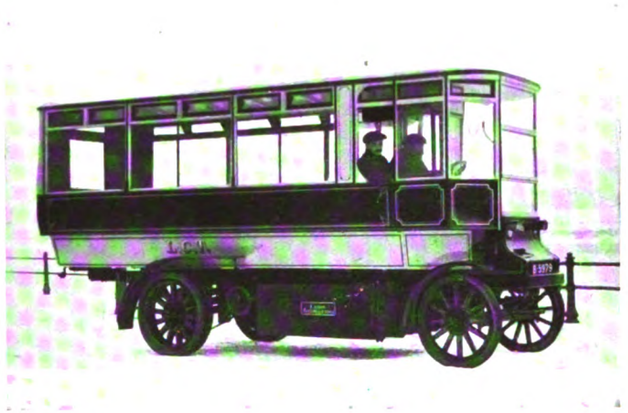
Supplementing the announcement in our issue of March 15, that the Lancaster Tramways Committee had decided to purchase two more battery-propelled omnibuses, it may be stated that the department have been operating three Edison accumulator omnibuses during the past four months. We are indebted to Mr. J. B. Patterson, the acting borough electrical and tramways engineer, for the photographs reproduced on this page, showing one vehicle from the



Front Entrance and Boosting of Battery—Lancaster Electric Omnibuses.

driver's side on the esplanade, while the other illustration shows the front entrance and also battery undergoing boosting. These vehicles constitute one of the few instances in this country of stage carriages operated by only one man, who drives and collects the fares when the passengers enter.

The three Edison "Detroit" chassis were supplied by Edison Accumulators, Limited, of London, while the bodies were built by the Brush Engineering Company, of Loughborough. Another feature of the body is that protection from the weather is afforded



Driver's Side of Lancaster Electric Omnibus.

to the driver and to the passenger on entry. Seating accommodation is provided for 22 persons, and the popularity of the vehicles is shown by the fact that the receipts are on an average 14·3d. per mile. From the point of view of reliability and regular running, the omnibuses have given entire satisfaction to the Tramways Committee. As to the working cost per car-mile, it is expected that the total will not exceed 9d., this figure including repayment of the capital cost in six years, interest, repairs, wages, and electrical energy.

The two additional omnibuses now on order are being supplied by Electromobile, Limited, of Leeds, and are fitted with Ironclad batteries, the vehicles being described as nearly "All British." The comparison of working costs of the two types of electric omnibuses after an adequate trial will be awaited with interest.

THE FOOTPATH RULE.

DOES IT CONTRIBUTE TO ROAD FATALITIES?

The London Safety First Council, appointed at a conference of representatives of public bodies, vehicle workers, omnibus and railway companies and transport firms in December last, are recommending to the authorities and the public that the present rule of the footpath, "Keep to the right," should be changed to "Keep to the left."

The Council state that, having consulted leading traffic experts and examined statistical and other data, they have arrived at the conclusion that the danger of accident will be greatly diminished if pedestrians acquire the habit of keeping to the left.

In 1916 nearly three times the number of fatal accidents occurred to pedestrians who stepped off the footpath from the near side, as compared with those which resulted from leaving from the off side, when the pedestrian is facing the traffic coming towards him or her.

Mr. H. E. Blain, operating manager of the London General Omnibus Company, upheld the recommendation of the Safety First Council in recently discussing the reduction of 18 in the number of street fatalities (83) in the county of London from the beginning of the year to February 28, as compared with the corresponding period of last year. The number of deaths attributed to omnibuses is 29 in the whole metropolitan area, which is six times the size of the county of London. Mr. Blain stated that "of the 29 people killed by omnibuses since the beginning of the year 22 were killed after dark, 21 being males and 8 females. The majority were people over fifty years of age. Many of these accidents were due to people stepping off the kerb with their backs to the oncoming traffic. This custom is largely due, I think, to the existence of the rule of keeping to the right on footways." Mr. Blain added that the speed of the omnibuses is legally restricted to 12 miles an hour, and any driver who gets ahead of the time allowed for his journey is fined. No fine is imposed for being behind time.

WAR USE OF BRISTOL MOTOR SERVICES.

N.S. VOLUNTEERS FOR TRAMWAYS AND OMNIBUSES.

In his speech from the chair at the annual meeting of the Bristol Tramways and Carriage Company, Mr. S. White mentioned that more than 400 of 1,600 employees who had gone into the army were fully-trained motor drivers, and these drivers had been particularly sought after by the recruiting officer by reason of their training and efficiency. The total number who had joined the forces from both departments of the company was equal to 70 per cent. of the staff, excluding those engaged on munitions. Such a depletion of their staff had necessitated considerable reduction of their services at certain hours, but as showing that the importance to the community of ample services of tramway and omnibuses was recognised, it might be mentioned that these industries had been included in the list of reserved occupations in connection with questions of military service, and that under the scheme of National Service volunteers were asked for to enrol for work on tramways and omnibuses

Notwithstanding the lesser number of vehicles running, the receipts had been more than maintained, and the war workers' traffic had been amply provided for. All over the country tramway undertakings had raised the fares, but Bristol had refrained from such step in connection with any of their public services, whether tramways, omnibuses, or motor cabs. With regard to omnibuses and cabs, the difficulties caused by the loss of men for military service had been added to by the increasing restriction of petrol supplies. The number of vehicles had had to be reduced, though he was glad to say that the receipts had not been diminished to a corresponding extent.

MECHANICAL TRANSPORT SUPPLY.—Mr. Percy Martin has been appointed Director-General of Mechanical Transport Supply and of Petrol Engine Supply, Ministry of Munitions, in succession to Sir Albert Stanley. Mr. Martin had already for some time been discharging the duties appertaining to the second part of the title of the now combined department, the offices of which are at the Grand Hotel, Northumberland Avenue, W.

OMNIBUSES AND ROAD LITIGATION.—Lancashire County Council have issued a writ against the Barrow-in-Furness Tramways Company, one of the British Electric Traction group, to recover £2,311, extraordinary expenses incurred in the repair of the Barrow and Ulverston Road, by reason of damage caused by the company's motor omnibuses from April 1, 1914, to March 31, 1916.

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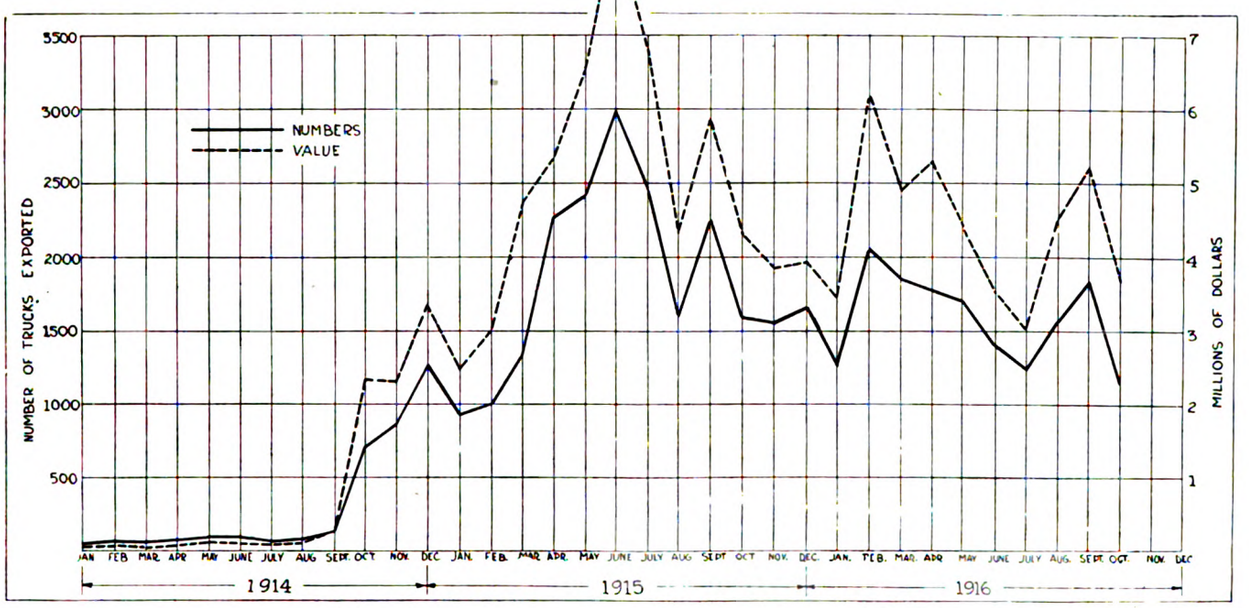
MOTOR TRAFFIC.

MOTOR LORRY EXPORTS FROM THE U.S.A.

The *Commercial Vehicle* of New York, in a recent issue, states that exports of motor chassis from the United States at the present time are only about 42 per cent. of what they were at the high-water mark reached in June, 1915. In that month almost 3,000 trucks, valued at more than $8,500,000 were shipped abroad. Since that time they have steadily decreased in both number and value with but five exceptions. In each of these five months the vehicles exported exceeded those of the months immediately preceding.

The war has, of course, been responsible for the great increase in motor truck exports. This is strikingly shown in the accompanying diagram, in which the heavy black line shows the variations in the number exported from month to month and the dotted line the monetary value.

In the seven months preceding the declaration of hostilities on August 1, 1914, the average number of trucks exported per month was 65. Then the governments of France, England, and Russia, realising their inability to produce trucks fast enough to meet their tremendous military transport needs, sent representatives to the United States to buy what was available.



Motor Lorry Exports from the United States, 1914-1916.

In September, 1914, the number of trucks exported was double the average number shipped in the eight preceding months. Then as American factories were enlarged and put under high working pressure to fill the orders placed, the exports increased by leaps and bounds to the high-water mark in June, 1915. This increase was steady with the exception of but two months, when sufficient shipping could not be secured.

The trucks shipped abroad up to the high-water mark were used almost exclusively for war purposes. Since that time, an increasing proportion of the exported vehicles have gone into commercial service in the warring nations to replace those private vehicles commandeered during the first stages of the war.

In all 41,441 trucks, valued at $112,865,887 were exported during 1914, 1915, and ten months of 1916. Although the high-water mark was reached in June, 1915, the exports of the other months of that year were so much smaller that the 1916 exports will be approximately 92 per cent. of those in 1915 in value and 90 per cent. in number if the average rate of the ten months of 1916 is maintained. The average value per truck exported during the entire period was $2,720.

Number of Commercial Vehicle Makers for 1917.

The annual specification tables covering petrol, electric, and steam commercial motor vehicles for 1917 show that there are 211 manufacturers of commercial vehicles. Of that number 200 are building petrol lorries, two steam, and nine electric vehicles. The models range from 10 cwt. to 7 tons and over, but of the latter there are only 18 types, five of them being electrically-propelled. Those of over 7 tons are tractors. Ninety-eight makers are building vehicles of 2-ton capacity, fifty-six manufacture 1½-ton machines, and fifty-three produce the 3½-ton type. The Ford Motor Company, of Detroit, confine their production of commercial vehicles to the 1-ton class.

In addition to nine manufacturers of electric commercial vehicles there are ten who produce what are termed electric industrial vehicles. These, however, do not offer so wide a range in capacity as the electric commercial cars. The latter comprise the following capacities :—10-cwt., 15-cwt., 1-ton, 1½-ton, 2-ton, 2½-ton, 3½-ton, 4-ton, 5-ton, and 7-ton. Only three types are shown among the industrial class, viz., 1-ton, 2-ton, and tractor.

Pneumatic tires are fitted to the 10-cwt. and to the majority of the 15-cwt. machines, while eight of the 1½-ton and one of the 2-ton type are so fitted. In addition to solid rubber tires there are cushion tires.

Two Years' Sales of Cars and Lorries

Despite the vast export of American cars and lorries to Europe in 1915 and 1916, the greatest part of the American production of motor cars was sold in the home market. Of lorries, however, the majority went to the nations engaged in war against Germany. The appended statistics show the sales and values of the two classes of vehicle for the past two years :—

	1915.	1916.
Passenger cars sold	842,249	1,525,578
Motor lorries sold	50,369	92,130
Total production of motor vehicles...	892,618	1,617,708
Retail value of passenger cars ...	£113,171,290	£184,275,600
Retail value of motor lorries ...	25,184,500	33,330,055
Total retail value of sales	£138,355,790	£217,605,655
Average price per car	£134 8s.	£121
Exports in first ten months ...	53,380	67,616
Value of exports, first ten months ...	£18,886,886	£20,009,527

The National Automobile Chamber of Commerce estimates that there were last year 3,500,000 motor vehicles in use in the U.S.A.

American Enterprise in Pekin.—It is reported from Pekin that an American company have obtained sanction from the city authority to inaugurate motor transport of passengers and goods between the centre of the city and the surrounding district. The same company have also undertaken to make the roads suitable for the traffic. Roads in the province of Chi-li are also being reconstructed for a similar purpose. In view of the lack of adequate railway facilities China is likely to become a ready market for motor vehicles.

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MOTOR TRAFFIC.

THE MOTOR TRADE AND TARIFFS.

Mr. Arthur Goodwin, of C. A. Vandervell and Company, has been elected for a second year of office as president of the Motor Traders' Association, which has 4,000 members in the United Kingdom. During the past year Mr. Goodwin's work on behalf of the association has proved of great value. The association was founded by manufacturers, and its first president was the chairman of the Daimler Motor Company. Its council consists of three classes of members, in equal proportions, viz., (1) manufacturers of motor cars, (2) manufacturers of tires and accessories and factors, and (3) retailers, so that there is always a dominating majority representing manufacturing interests.

It is of interest to note that Mr. Goodwin is the latest well-known worker in the motor industry to be interviewed by the *Financial News* on the question of post war policy of the trade and the institution of protective tariffs as advocated by Mr. C. A. Vandervell. Other gentlemen interviewed have been Mr. E. M. C. Instone, of the Daimler Company; Mr. H. T. Vane, of D. Napier and Son, Limited; Mr. T. H. Roberts, of Wood-Milne, Limited; Mr. J. Nuttall, of Belsize Motors; and Mr. S. Straker, of Straker-Squire, Limited. The event proved that, with one exception, all strongly endorsed Mr. Vandervell's views.

In the course of his remarks Mr. Goodwin said:—"In the past, as Mr. Vane has so aptly put it: 'We have been a very hospitable people; but in the near future it will be our serious business to keep the house over our heads.' I like the suggestion of treating neutrals in the most friendly manner imaginable—by treating them just exactly as they behave to us! I can endorse without qualification his denunciation of the misuse of the word 'British' in connection with businesses having nothing British about them, excepting a local habitation and a name—the former a dumping ground, the latter a disguise. While I am in favour of the protective tariff, I would prefer to treat the case of any particular foreign competitor upon its own particular merits. If our programme 'placed' Allies in the most favourable category, neutrals in a less favourable category, and enemies in a most unfavourable category, would the fact that America, at the eleventh hour, became an ally, materially change our post-war trade policy in relation to that country? I do not think it would.

Specialisation and Standardisation.

"As Mr. T. H. Roberts, speaking for the British tire industry, has pointed out, the American manufacturer has taken the utmost advantage of our tied-up condition, and has done everything, by cutting prices in the colonies, and by giving big discounts, to capture our trade. We can hardly allow a death-bed translation from the category of neutral to the category of ally to obscure the fact that for two and a half years America has cut into our unprotected vitals, nor to tie our hands in the future. Speaking personally, I should prefer not to prejudice our future trade action by drawing definite lines of demarcation to-day. My own hope in that connection is that this war will lead to a reduction of the number of those enemies, by the linking-up of certain national trade interests through the machinery of fiscal reciprocity—an extension of the Empire idea, to cover, un er whatever conditions may be found workable, at least some of those peoples who have stood with us in the war."

"Do you hold, with Mr. Straker, that our methods are open to improvement—that they must come up for revision and reconstruction? Or on what lines should we develop our interests?"

"I should prefer not to take a line that would savour of advice to other manufacturers as to how they should conduct their businesses In the C.A.V. electrical business we have been careful to perfect our methods, in anticipation of American competition. And we have done that by robbing the Americans of their 'specialisation' thunder—which, incidentally, was not so wholly theirs as all that. I daresay that Mr. Straker was entirely right in suggesting that in the motoring industry much improvement was possible. And, if I may judge from my own experience, that improvement must take the form of much more intensive specialisation, with standardisation for its outward and visible sign."

Mr. Sydney Straker and Single Unit Conditions.

Mr. Sidney Straker, when interviewed, insisted that the system hitherto in vogue in this country has got to be readjusted to deal with the new conditions, and that the world's experience in respect of production must be drawn upon and turned to the best account. All large factories, in his opinion, have been manufacturing too many types, and these it will be necessary to reduce substantially in order to get full value from the works. It is a question, he is disposed to believe, whether many of our manufacturers realise, as they should, the exceptionally low production cost procurable when working under single unit conditions. It is his opinion that the main features imperatively demanding attention as controlling the destinies of the industry in this country are four: Special machinery, large outputs, secure markets, and adjustment of labour conditions.

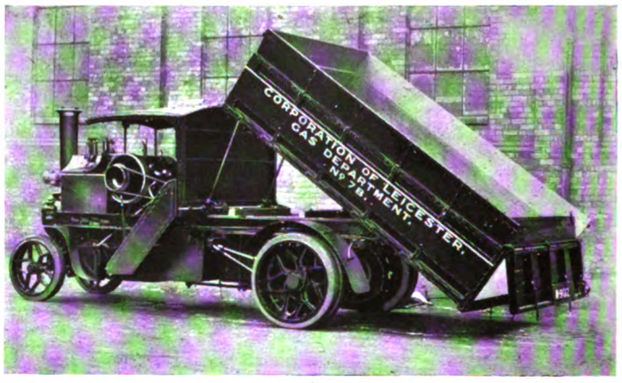
POOLING PETROLEUM DISTRIBUTION.

In the House of Commons, on March 28, Mr. Joynson-Hicks asked the President of the Board of Trade whether, at the request of the Ministry of Munitions and the Admiralty, a recent attempt was made to pool all petroleum products in this country and so economise in transport and personnel; whether the Shell Company, the Standard Oil Company, and other producers all agreed, but the German-owned British Petroleum Company, the control of which was with the Board of Trade, refused to agree; and why this was so.

Mr. Roberts said the Ministry of Munitions, the Admiralty, and the Board of Trade had intimated to the principal importing and distributing agencies of petrol products in the country the desirability of coalescing their organisations, and a scheme would shortly be in full working order. The answer to the second part of the question was in the negative, and the last part therefore did not arise.

FODEN STEAM WAGON FOR MUNICIPAL WORK.

Subjoined is an illustration of a 5-ton steam wagon supplied to the gas department of Leicester Corporation. An order for a similar vehicle has been received from Sheffield Corporation. This model is fitted with tipping apparatus and rubber tires. The body is



10 ft. long by 6 ft. 6 in. wide, by 3 ft. deep. The high state of efficiency to which the Foden vehicle has been brought at the Elworth Works, Sandbach, has proved of great advantage for heavy traction during the war, its economical running and freedom from breakdowns being very pronounced.

Karrier Staff Annual Gathering.—For several years past it has been customary for the staff of Karrier Motor Works, Huddersfield, to have an annual dinner, but this year, owing to the food problem, and for patriotic reasons, the dinner was abandoned, and a smoking concert was given on March 24. About 70 gentlemen, including visitors, directors, members of the executive, office staff, and works staff attended. Mr. R. F. Clayton was in the chair. Mr. J. E. Roberts (Messrs. Abraham Roberts) proposed "Success to Karrier Cars." Mr. Roberts has known the firm from its inception, and has been associated with the directors for at least 18 years. He referred to one of his favourite mottoes, "Masters and foremen foremost," and explained how those who were doing their "bit" conscientiously were furthering the welfare of the country. Mr. R. A. Jones, who until recently was a lieutenant in the Motor Transport, but has been "released" in order to devote his energies to works promotion matters, remarked what pleasure it gave him to be once more in the busy hive of which he is one of the directors. The chairman expressed the directors' appreciation of the *esprit de corps* of the staff, and their gratification in seeing such evidence of camaraderie around him.

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PIONEER IN TRACTION AND FLIGHT.

THE LATE SIR GEORGE WHITE'S SERVICES TO THE NATION.

A graceful tribute to the work of the late Sir George White, chairman of the Bristol Tramways and Carriage Company, Limited, was paid at the annual meeting of the company on March 19 by Mr. S. White, J.P., the new chairman. He could not, he remarked, express his feelings on finding that after the long period of 42 years they were deprived at that meeting for the first time of the presence of the late chairman, who was always the life and soul of every enterprise with which he identified himself. The company might rightly be looked upon as his child. He was appointed secretary at its formation in 1874, and he became more and more responsible for the direction of its policy, and for the great developments of its operations. When mechanical street traction first became practicable, he was quick to make this company a pioneer in its introduction. Tramway systems in Bristol, Dublin, Middlesbrough, and London were constructed on his initiative, and there soon followed deputations from all parts of the country to Bristol to see its installation, with the result that companies and corporations soon followed the Bristol lead, and an electric tramway system became a necessity of life in every community of any size. Later on motor traction was introduced, and here again their late chairman grasped at once its possibilities. Long before the experimental stage had been passed, it was introduced to Bristol by this company, enabling them to obtain the experience for arriving at the present advanced stage to which the industry had developed. Following motor traction came aviation, and it would not be too much to say that the nation owed a debt of gratitude for the first establishment in Bristol on a large scale of the business of aircraft construction, enabling at the outbreak of war the immediate supply of aircraft and trained pilots, a need of vital importance to the nation at a time when other sources of supply were for all practical purposes non-existent.

DEMOUNTABLE TIRES.

A PRODUCT OF THE B. F. GOODRICH COMPANY.

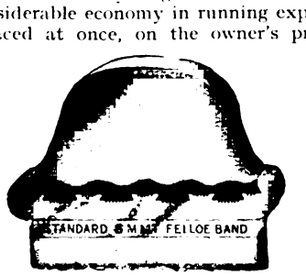
The illustration produced on this page shows the demountable tire for commercial vehicles introduced by the B. F. Goodrich Company, Limited, 117-123, Golden Lane, E.C. At present it is made in inch sizes only, but it is in wide use in the Colonies, where the conditions demand a tire constructed on simple lines—easy to fit or remove, yet secure and reliable. Fulfilling these requirements, it will appeal to owners of commercial motors whose fleet is not large enough to justify the purchase of a hydraulic press, or whose headquarters are at some distance from an established fitting depot. Any ordinary wooden wheel may be readily converted for use with this type of tire, which is suitable both for single and twin rims, and its special advantages may be summed up as follow :

1.—Can be fitted or detached in a few minutes with an ordinary spanner.

2.—Extremely simple, yet perfectly secure.

3.—Easily removed after any length of time.

4.—Effects considerable economy in running expenses, as a worn tire can be replaced at once, on the owner's premises, without



placing the vehicle out of service. This saves the time and cost of carriage involved in sending away wheels to be fitted.

5.—The tire itself is of precisely the same quality as the Goodrich pressed-on type, which means that it is full of life and resiliency, capable of resisting road shocks and absorbing vibration throughout 'ong service.

The illustration shows the rubber tread built up on a steel foundation ring (" D "), which is divided into four segments to allow for expansion when fitting the tire to wheel. The ends of this ring slant, so that when the side flanges (" A ") are contracted, by tightening the bolts, the segmental steel base of the tire is forced in the direction of the double arrow (" B ") through the action of the bevelled edges of the flanges and steel base of the tire (" D "). As an added preventive against circumferential creeping, one transverse key is secured to the steel band fitted round the felloes of the wood wheel, with which a corresponding keyway in the tire registers.

LONDON GENERAL OMNIBUS COMPANY.

The report of the London General Omnibus Company for the past year shows that the gross receipts amounted to £3,920,736, and the expenditure to £2,688,779. The sum of £198,330 is allowed for depreciation of leases, plant, machinery, etc., and the reserve for contingencies and renewals, leaving a balance at the credit of the revenue account of £205,626. Adding the balance from the last account of £23,237 and interest and dividends on investments, £73,092, there is a balance of £301,957. Interest and amounts written off preliminary expenses and discount on issues of debenture stock absorb £116,490, leaving a profit balance of £185,467. An interim dividend of 5 per cent. had been paid, and a further dividend of 3 per cent.—making 8 per cent. for the year—leaving a balance to be carried forward of £21,417. During the year the company has spent £26,057 on the purchase of land and the construction and equipment of new garages.

REDUCED DIVIDEND FROM THE ASSOCIATED EQUIPMENT COMPANY.

The issue of the report of the Underground Electric Railways Company of London explains the falling off in the recent dividend statement of the allied companies. The net income from investments was £42,700 less, at £664,666, and its interest and guarantees, plus income-tax where paid, required £227,853, leaving a surplus of £436,812, as compared with £477,307 reported a year ago. The income-tax paid on the bonds, and the loss on foreign exchange in respect of coupons encashed abroad, amounted to £134,015, an increase of £56,805, whilst the income received from the Associated Equipment Company was £143,000, as compared with £170,000.

It was stated by the chairman of the London Underground Electric Railways Company at the annual meeting that the decrease of £27,380 in the income was practically equal to the reduction in the dividend of the Associated Equipment Company, the return from the transportation companies being practically the same as for the previous year. The improvements and extensions to the factory of the Equipment Company should, he added, materially increase the output of that company in the current and future years.

L.G.O. COMPANY'S WAR CLAIM.

The Defence of the Realm Losses Commission on March 1 reserved their decision in the claim made against the War Office by the London General Omnibus Company in respect of two garages requisitioned by the military in July, 1916. At the time possession was taken the company agreed to let the garage at £850 per annum. A portion of it had also been let to the Belgian Government before the military occupation. As to the other garage, £45 5s. 8d. was claimed as the cost of removing the omnibuses and an annual rent of £325.

The claimants' solicitor stated that it was possible that an enormous claim would be made in addition, as the Government had taken about 1,350 of their omnibuses, and the company had placed their works at the disposal of the Government.

ECONOMY OF MUNICIPAL MOTORS.

Brighton Corporation are obtaining two motor vehicles for street watering and general haulage at a cost of £2,020. One will be a 3½-ton battery chassis and the other a 5-ton steam wagon. Each will have interchangeable bodies. It is also proposed to use them for ash collection in certain places where arrangements can be made for quick loading. The Corporation's decision was arrived at after considering a report presented by the surveyor and the chairman of the Works Committee upon the result of their visits to a number of towns where such vehicles are in use. It is estimated that the cost per day (including depreciation, maintenance, and interest) of the steam wagon will be £1 3s. 8d., and of the electric vehicle £1 7s. 7d. The present cost for horse and driver is 11s. 4½d., and it is said that the two machines will do the work of six horse vehicles.

The following tenders have been received for the supply and delivery at Brighton of the two vehicles :—

Steam motor wagon, rubber tires, capable of carrying 5 tons and drawing 3-ton trailer if required, with automatic tipping gear, convertible body for haulage, and 1,000-gallon watering tank with front delivery :—Alley and MacLellan, Limited, Sentinel Works, Shrewsbury (recommended for acceptance), £940 ; Aveling and Porter, Limited, Rochester, £890 ; Yorkshire Commercial Motor Company, Leeds, £885 ; Fodens, Limited, Sandbach, £850 ; Mann's Patent Steam Cart and Wagon Company, Limited, £827 ; Clayton and Shuttleworth, Limited, £815.

Electric motor wagon, rubber tires, capable of carrying 3½ tons, with electric tipping gear, convertible body for haulage, and 750-gallon watering tank with front delivery :—Mossay and Company, Limited, Westminster, S.W. (recommended for acceptance), £1,080 ; Electromobile (Leeds), Limited, Leeds, £1,152 ; General Vehicle Company, Limited, London, W.C., £1,350 ; Edison Accumulators, Limited, London, £1,420.

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MOTOR TRAFFIC.

OMNIBUSES WEAR AND TEAR ALLOWANCES.

The following circular has been issued by the Board of Inland Revenue to surveyors of taxes :—

"The Board have recently been approached by representatives of the Tramways and Light Railways Association and other similar associations with a view to an agreement as to the proper allowances to be granted in respect of the wear and tear of motor omnibuses. As the result of negotiations which have taken place the Board have agreed to the following proposals, subject to the approval of the District Commissioners :—(*a*) That the allowance for the four years commencing with 1916-17, in addition to any appeals at present outstanding for prior years, be 20 per cent. on the written down value. (*b*) That at the end of the said period the rate be reconsidered. (*c*) That as regards excess profits duty cases, inasmuch as the rate is intended to be regarded as a special rate necessitated by the war, it be applied to all accounting periods where claimed. It should be noted that where more than 20 per cent. is already allowed, the reduced rate is to be applied. These proposals do not apply to commercial motor vehicles."

FORD FACTORY FOR IRELAND.

GOVERNMENT OFFER TO BRITISH FIRMS.

In the House of Commons, Mr. Kellaway, of the Ministry of Munitions, answering an inquiry by Colonel Gretton as to whether the erection of a factory for the production of motor tractors at Cork by the Henry Ford Company of America had been sanctioned, said :—A licence has been issued to Messrs. Ford subject to the condition that they are to confine their manufactures during the war to agricultural machinery, and that they should import their own plant and material, except so far as sanctioned by the Minister of Munitions, and also comply with the directions of the latter as to conditions of employment and rates of wages. The whole matter was carefully considered by the Government, and it was decided that it was desirable to issue this licence in view of the urgent necessity for ample provisions of agricultural tractors for use in the United Kingdom in the immediate future. In order that British industry may not be placed at a disadvantage thereby, negotiations have been opened with British firms in the hope that they will act together, and if suitable arrangements for the organisation of a similar factory in this country can be arranged the Government will afford all possible facilities.

MOTOR VEHICLES FOR MUNICIPALITIES.

FOLKESTONE COUNCIL are purchasing three steam tractors at an estimated cost of £2,500.

GLASGOW TRAMWAYS COMMITTEE have obtained tenders for an electrically propelled road vehicle.

BOOTLE COUNCIL have ordered two 5-ton tipping wagons of the General Vehicle Company's manufacture.

POPLAR BOROUGH COUNCIL have accepted a tender for a Bessemer petrol wagon for the electricity department, at £745.

MANCHESTER ELECTRICITY COMMITTEE have placed a contract for the supply of a General Vehicle 5-ton electric tipping wagon.

BRADFORD CORPORATION have placed a repeat order for two 5-ton General Vehicle Company's electric wagons fitted with tipping apparatus, for the electricity department.

WIGAN TRAMWAYS COMMITTEE have received the sanction of the Council to purchase a motor tower wagon. The manager has been in negotiation for the chassis of a certain maker, but the Ministry of Munitions have refused to allow it to be supplied.

SHEFFIELD CITY COUNCIL have ordered a 5-ton steam tipping wagon, with rubber tires, from Fodens, Limited, Sandbach, a similar vehicle from the Yorkshire Commercial Motor Company, and a 2-2½ ton Orwell electric lorry from Ransomes, Sims and Jefferies, Limited.

MARYLEBONE BOROUGH COUNCIL have been recommended by a committee to accept the tender of the Austin Motor Company, Limited, of Longbridge Works, Northfield, Birmingham, and 479-483, Oxford Street, W., to supply six motor lorries. The price was given as £745 each. The council propose to use the vehicles for dust collection.

THE SHREWSBURY AND CHALLINER TYRE COMPANY, LTD., Ardwick Green, Manchester, are the successful tenderers for the supply of tires for the Manchester Corporation's motor omnibuses, motor tower wagons and horse wagons for the twelve months ending March 31, 1918.

MOTOR TRAFFIC NOTES.

NEW LONDON OMNIBUS GARAGE.—Bromley Council have approved of the plans submitted by the London General Omnibus Company for the erection of a garage to accommodate the numerous vehicles now required in that distant southern suburb owing to the growth of omnibus traffic. In the metropolitan area the company have 25 garages, the majority having been built during the past ten years.

OMNIBUS DRIVERS AND MILITARY SERVICE.—Tribunals throughout the country have responded to the requests of the military representative to cancel the exemption of motor omnibus drivers under 31 years of age who are passed for general service. Thos. Tilling and Company, Limited, who now control the entire omnibus service at Brighton and Hove, have been granted three months' exemption for all drivers between 31 and 35, with leave to apply again.

CHARGING ACCUMULATORS FOR MOTOR PLOUGHS.—For the purpose of providing light for the ploughing which is being carried on at night by motor tractors, the Government are sending out electric lighting sets worked from accumulators. If necessary the organisers fall back on acetylene lighting, but as calcium carbide is scarce and dear, reliance is placed upon local facilities for charging accumulators. The Board of Agriculture call upon all who can help in this way to do what they can. The call will be willingly responded to by managers of stations within reach of cultivated districts.

WOOD PAVING PROSPECTS.—In his address from the chair at the 45th ordinary meeting of the Improved Wood Pavement Company, Limited, Mr. J. McKerr observed that up to the commencement of the war their system of wood pavement had been making rapid strides, and ousting other forms of paving. In the present critical times there was neither labour nor money to spare for improvements, and only the most urgent cases of renewal or repair could be done. When industry resumed its normal conditions there would not only be a large amount of renewals, but there would be large areas converted to a wood surface, in order to withstand the wear of motor traffic.

DEPRECIATION OF MOTOR VEHICLES.—In his remarks at the annual meeting of the Bristol Tramways and Carriage Company the chairman (Mr. S. White) stated that with regard to the depreciation of motor vehicles and plant, they had deemed it advisable to make more provision than would be necessary in an ordinary year, as at the present time, owing to the shortage of labour and the difficulty of obtaining spare parts, it was impossible to maintain their motor vehicles and plant at their usual standard. In the revenue account there was an item of £2,819, representing the loss on a sale of carriages and harness. The horse carriage business became each year of less importance, and last year it was necessary to dispose of obsolete carriages and harness.

PROGRESS OF THE ELECTRIC VEHICLE.—American newspapers report that a new model of an electric passenger vehicle recently ran from Columbus Circle, New York City, to the Hotel Taft, New Haven, Connecticut, a distance of 88·2 miles. The vehicle carried three passengers, and the route was over an extremely hilly district, but the journey was accomplished in 3 hours 45 minutes, including all stops and delays, and on a single charge of the battery. While the speed of about 23 miles an hour would not attract much attention, the fact that the speed was maintained over rough roads indicates that the electric vehicle has a very wide field of usefulness. Other long runs with electric vehicles have recently been reported from America, among them one from Chicago to Milwaukee, a distance of just over 100 miles.

ENTERTAINMENT OF WOUNDED SOLDIERS AT KARRIER WORKS.—On March 21 the Karrier Motor Division of the St. John Ambulance Brigade, at Huddersfield, gave a tea and concert to 171 wounded soldiers from the war hospitals at Bradley, Meltham, Crosland Moor and Royds Hall. Men of the R.A.M.C. and the St. John Ambulance were in attendance to assist certain of the guests who had been badly disabled. The guests sat down to a sumptuous tea prepared in the men's dining hall. After tea, a well-thought-out smoking concert was given in the women's dining hall, which had been somewhat altered for the purpose, and accommodation provided for close on 200 guests. Many of the Karrier works staff were present. A most enjoyable programme was gone through, all the performers, with three exceptions, being employees of Messrs. Clayton and Company's Karrier motor works. The success of the proceedings was indicated in the few remarks offered by one of the guests in proposing a vote of thanks to the hosts. The proposer expressed the hope that the officers and men of the Karrier Division had received as much pleasure in the giving of the tea and concert as the soldiers had had in receiving such kind hospitality. Hearty cheers greeted the observation.

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THE Tramway & Railway World
WITH MOTOR TRAFFIC SECTION

Founded 1892. LONDON, MAY 10, 1917. VOL. XLI.

A NEW TYPE OF CAR AT SOUTHAMPTON.

These days of scarcity of labour, of short supplies, and of high prices for materials are not favourable for carrying out on any considerable scale new ideas as to tramway plant or equipment. The very peculiarity of present circumstances, however, sometimes gives managers and engineers an opportunity for preparations for the great advances and heavy work which must come at a bound when peace is restored; and where practicable it is good policy to carry out any necessary experimental work now, so that "full speed ahead" may be the motto when the desired time comes. This course is being followed in some instances

A New Type of Car at Southampton.

thinking out new devices or improved designs which they hope to develop after the war. Several instances of such commendable foresight have come under our notice, and we make no doubt that many other innovations of which nothing has yet been heard are being worked out. It is, of course, a plain duty as far as possible to take time by the forelock and to make in connection with modified types of cars, and a good example is to be found in what has been done by Mr. W. T. Robson, general manager and engineer of Southampton Corporation Tramways.

As was shown by his paper read before the eighth annual conference of the Tramways and Light Railways Association, held in London on June 30 last year,

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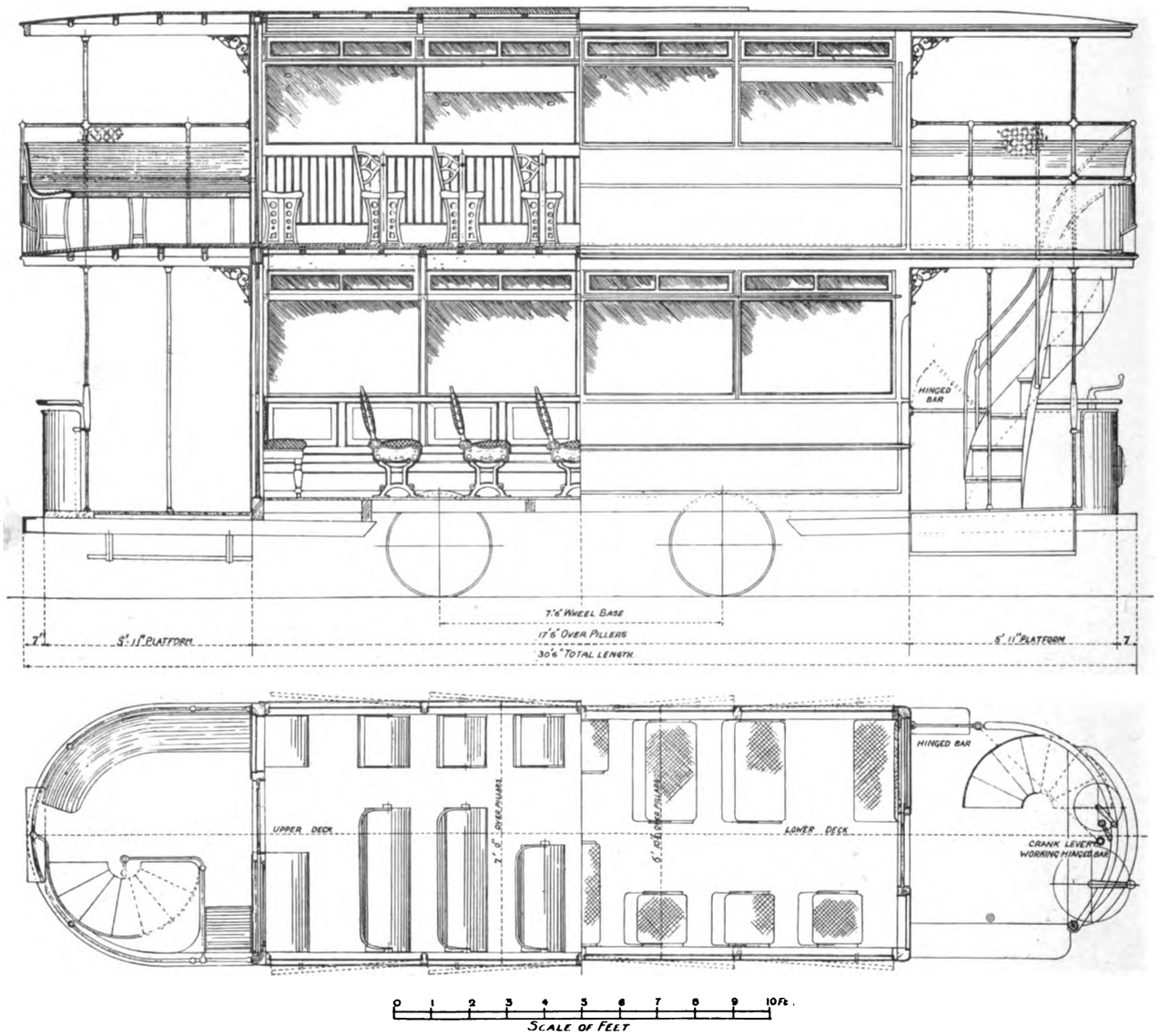
Mr. Robson has for some time been devoting his attention especially to the comfort of the passengers. Every manager, of course, must have that factor in his mind, but Mr. Robson departed from the usual practice in technical papers by discussing many tramway questions solely in their bearing on that matter. In the paper referred to (published in our issue of July 13 last) he dealt with the track, rail cleaning, trucks, brakes, seating, ventilation, exits, interior finish, top covers, and other matters—all from the point of view of how they affect the passenger. That much-sought-after individual is to be attracted by more and more convenient arrangements. Efficient services were not left unconsidered, but Mr. Robson paid more attention to the car than to any other single item. He had many suggestions which taken together approach his ideal car, and as far as circumstances have permitted they are embodied in the new car which he has now completed. As the car will be the precursor of other improved vehicles in Southampton when peace conditions return, it will be useful to consider some of the points raised by his paper, and the extent to which they have been applied.

In regard to trucks and hand brakes, Mr. Robson pointed out in his paper that for many years practically no change in type has been adopted, and that radical improvements are called for. As to seating, he expressed surprise that the use of cross seats in the lower saloon has not become more common. The advantage of being able to tell at a glance how many seats are vacant is obvious, and there need be no sacrifice of capacity as compared with longitudinal seats. It is more pleasant to face the way the car is travelling, and the uncomfortable situation which exists when a passenger is obliged to sit immediately opposite someone whom he dislikes intensely is rendered agreeably impossible. He warmly recommended the cross seat to those considering the question of new rolling stock. He also advocated rattan spring seating in place of the hard wood which communicates every jolt direct to the passenger. He considered that ventilators should be fixed, and not subject to the whim of any passenger; they should open outward on a quadrant in the direction in which the car is travelling. In old cars which have no ventilator windows a good plan is to insert wire gauze at the top of the door window, or induced draught from a fan might be employed. He also pointed out the great advantages of adopting a near-side exit on the front platform. With respect to interior finish, he recommended the contrast provided



Plan and Elevation of New Type of Car at Southampton.

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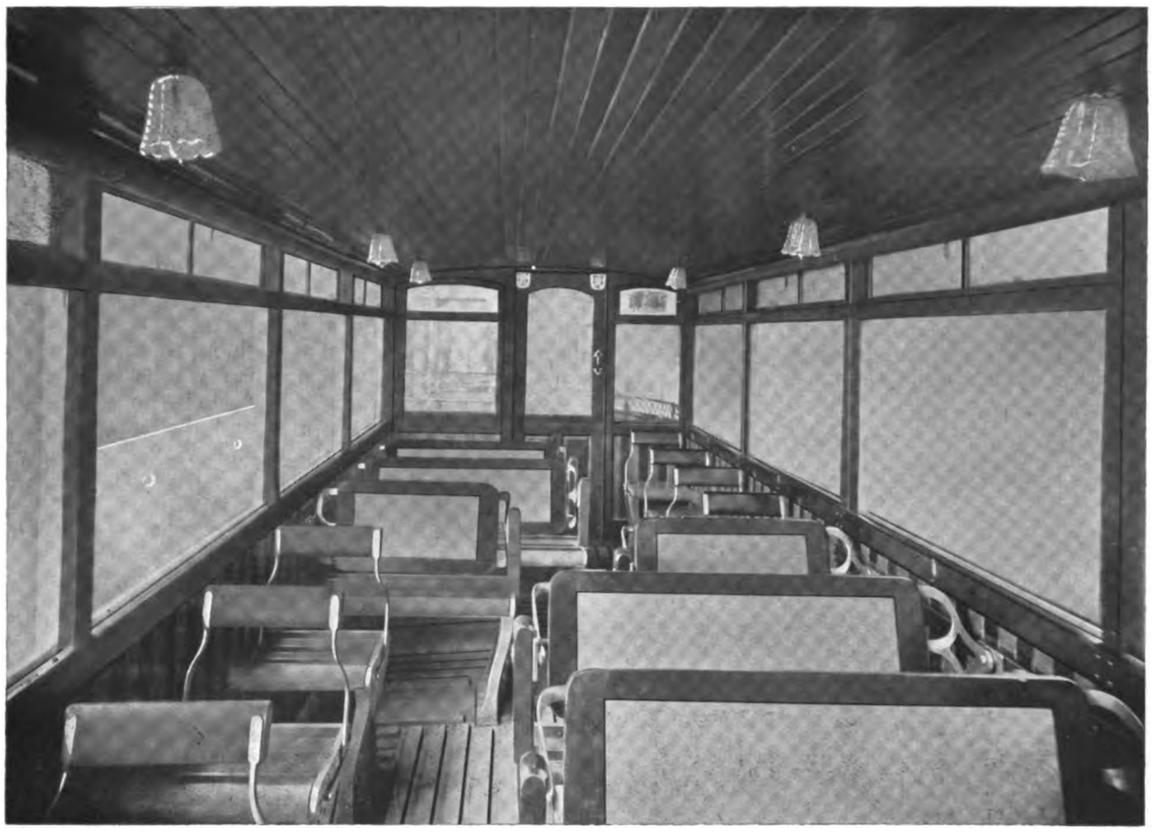
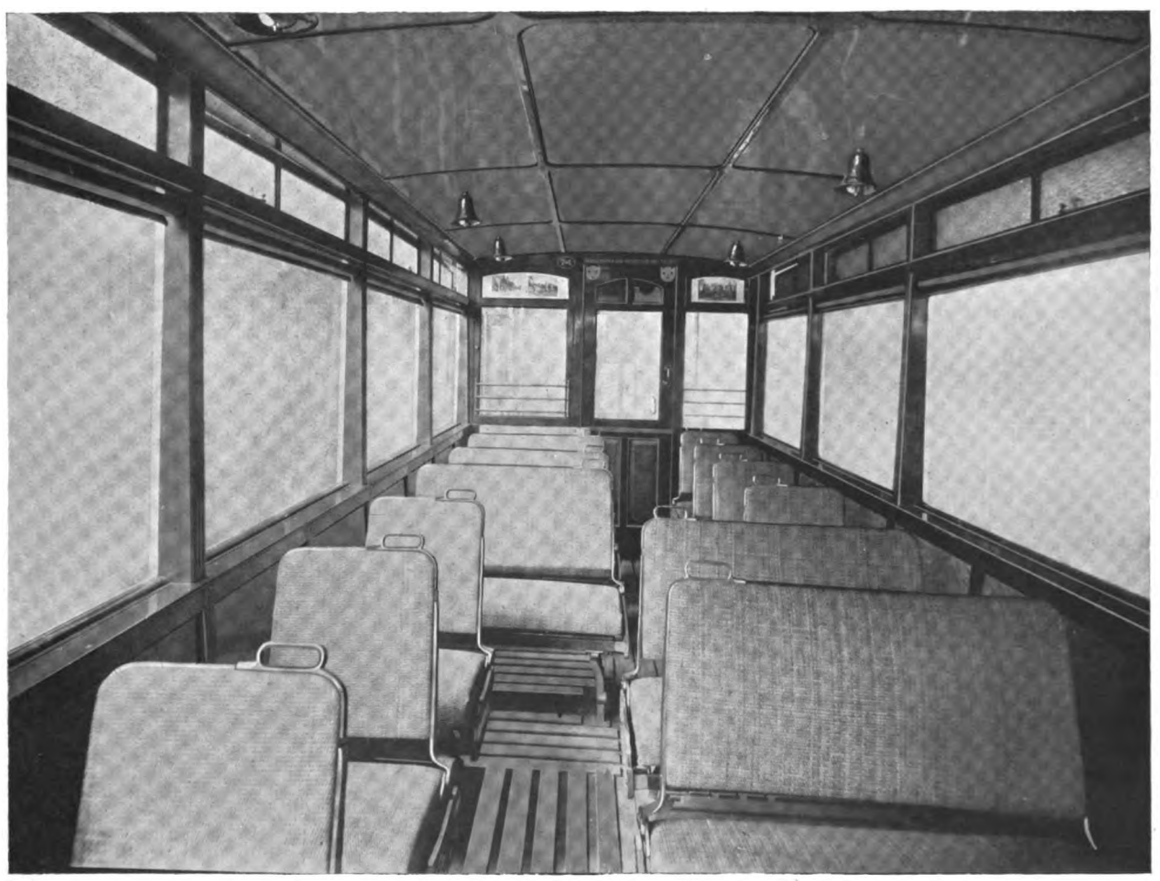


Interior of Upper Saloon.



Interior of Lower Saloon.
Arrangement of Seats in Southampton Car.

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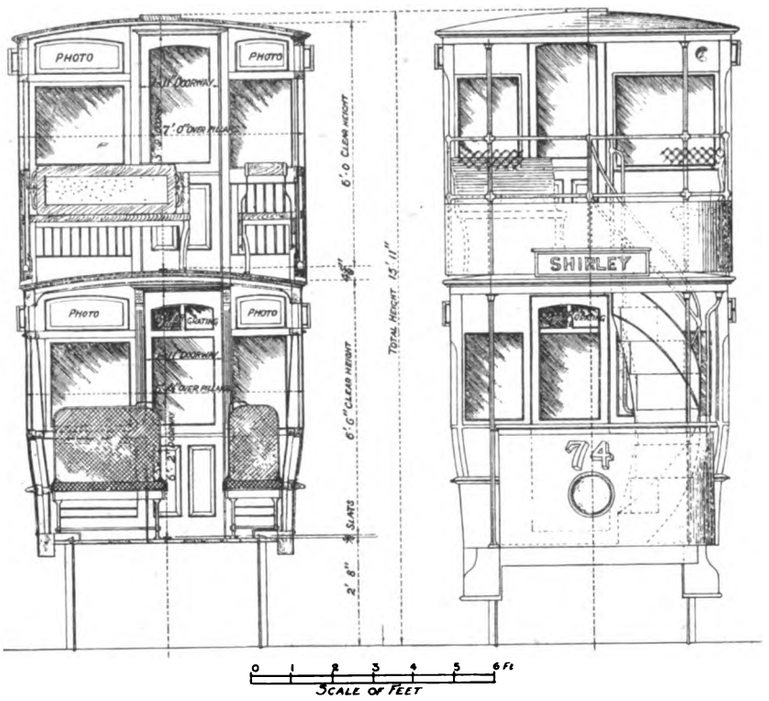
by oak and mahogany. Corners should be rounded, and ornamental mouldings and dust traps avoided. The interior of the upper saloon should be made as attractive as that of the lower; an interior finish of alternate light and dark matchboard, with sashless lazy-tongs windows and tip-up seats, with a row of ventilator windows to match those in the lower saloon would give a wholesome, attractive effect. The seating should be improved; the outside canopy seats especially are often uncomfortable, as they have no other back than the iron rail.

Coming to the present experimental car, the time is opportune for improvements at Southampton, as the cost of a large number of the existing cars has just been cleared off by the sinking fund. When normal times return many of these old cars will probably be replaced; and the present experiment was made with a view to determining the type most suitable for Southampton. After the car has been running for some time it will be possible to determine whether any modification in design would be desirable for the cars which are to follow. It will be seen from the following description, and also from the illustrations, that the present car conforms in many respects to the ideas set out in Mr. Robson's paper before the Tramways and Light Railways Association.



End Elevations of Southampton Car.

The car is of the four-wheeled double-deck type, with roof cover and open canopies. The front platform near side exit is embodied in the design, the staircase being so arranged that passengers can make use of the exit. It is closed when required by a hinged bar. The photographic views of the two saloons show that the cross seats have been employed in both. Though the Southampton tramways are of standard gauge, the seats are arranged to accommodate only three passengers abreast—two on one side of the gangway and one on the other. In this way more roomy seats and a wider gangway are obtained than if every seat were made for two passengers. The Southampton traffic includes a large number of what may be called residential passengers, and therefore this arrangement is of considerable importance. The canopy seat is something of a novelty; it consists entirely of cane, curved to the same radius as the canopy rails, and so shaped as to be thoroughly comfortable. An experiment has been made on the floor canopy with marbolith composition, which has proved very successful, as it is cleaner and more pleasant to walk on than the usual laths. There is throughout an entire absence of ornamental mouldings and dust traps, so that cleaning is easy.

The seating capacity is as follows:—Lower saloon, 21; upper, 28; on canopies, 10; total, 59. The leading dimensions are:—

Length over all	30 ft. 6 in.
Length over pillars	17 ft. 6 in.
Length of platforms	5 ft. 11 in.
Wheel-base	7 ft. 6 in.
Width over pillars, lower deck ...	6 ft. 10½ in.
Width over pillars, upper deck ...	7 ft.
Height of sill from ground	2 ft. 8 in.
Height inside lower saloon	6 ft. 6 in.
Height inside upper saloon	6 ft.
Total height above rails	15 ft. 11 in.
Width of doors	1 ft. 11 in.

The following are some details as to body construction. The floor framing is of oak. The platform floors are supported on steel angle bars, to which are secured ash end-bars. The floor is of ⅞ in. red pine boards, with 2½ in. oak wearing slats. The body framing is of teak, oak, and pitch pine, and the panels above and below the fender rail are of mahogany. The roof frame is of ash stiffened with steel. Three-ply maple veneer is used for the ceiling, with a light inner roof above of canary whitewood ½ in. thick, covered with cotton duck. The upper deck is of ⅞ in. pitch pine boards laid on ash bearings. The small ventilating sashes above the windows open outwards on a quadrant. Wire gauze gratings are fitted in the small panels of the doors. The interior finish is in mahogany framing. Ceiling joints are covered by plain rounded mouldings and a plain hollow cornice above the windows finishes the ceiling. The panels under the windows are of bird's-eye maple with mahogany framing. Over each end window is a glazed frame for holding photographic views. The rattan seating was supplied by the General Seating Company, London.

In regard to the upper saloon arrangements, the pillars, longitudinal rails, and end framing of the top cover are of teak. The side panels are of mahogany ½ in. thick, and here also the joints are covered by moulds. Below the windows is the dado cased with alternate matchboards of errol and pitch pine. The windows are mounted on lazy-tongs balancing gear, and the ventilation sashes are similar to those in the lower saloon. Ash roof ribs strengthened with steel are employed, and are boarded outside with ⅞ in. pitch pine boards. The inside boarding consists of narrow matching of Sequoi and pitch pine. The end panels are of teak, and here photograph frames are also provided. Errol wood and pitch pine slats are used for the seats, and the backs are framed with maple veneer panels. The curved canopy seats have already been alluded to.

The whole car is a workmanlike job, and it will be interesting to learn how far the local public, in the opinion of Mr. Robson, will appreciate the innovations.

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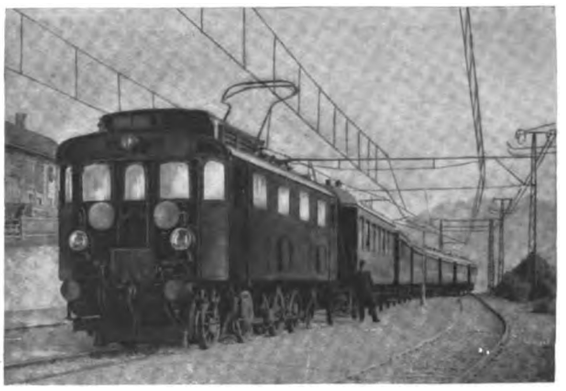
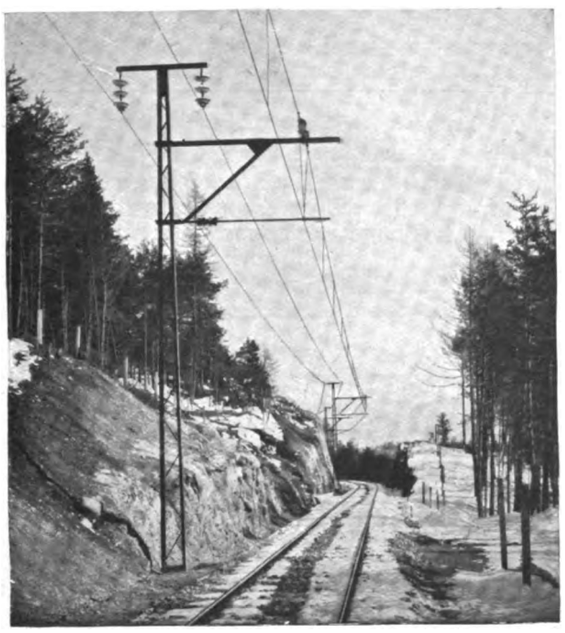
THE MITTENWALD RAILWAY.

The Mittenwald Railway is a striking example of the adaptability of electric traction to the most difficult conditions. The total length of the railway is 65 miles. Beginning at Innsbruck, on the River Inn, it continues in Austrian territory to Scharnitz (21 miles). There it crosses the frontier and enters Bavaria at Griessen (25 miles). On re-entering Austria, and following a north-easterly direction, it reaches Reutte, 19 miles from Griessen. From Innsbruck to Reutte, respectively the eastern and western termini, the route is in a district grandly Alpine in character. There is perhaps no other section of a railway of equal length which contains more engineering constructional works. In a distance of 38 miles there are no less than 18 tunnels, with a total length of 2·7 miles. One alone is 1,959 yards long, and there are in addition bridges, viaducts, and numerous similar works. The more important of these works include the Inn bridge, which consists of two arches each of 165 ft. span,



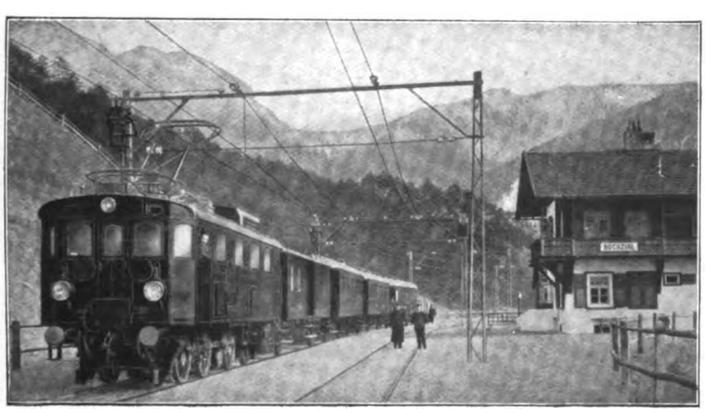
Electric Train on Mittenwald Railway.

a masonry viaduct 950 ft. in length, and a Schlossbach bridge over a ravine 170 ft. wide. The difficulties of the situation rendered heavy gradients unavoidable, and the engineers decided that unless the length of the railway was to be unduly increased a gradient of 3·64 per cent. must be permitted. Steam in these circumstances was out of the question, and electric traction afforded the only economical solution of the problem. An abundance of water-power was an influential factor in the decision. A power station was built about four miles south of Innsbruck, and here there is a fall of 340 ft.



Lattice Poles Carrying Transmission and Contact Lines.

Lattice Pole Carrying 50,000-Volt Transmission Line.



A Typical Station on the Mittenwald Railway.

The original equipment consisted of two 4,000-H.P. Voith Pelton turbines coupled direct to single phase generators capable of a continuous output of 3,000 K.V.A. The generators run at 300 revolutions per minute, conditional upon the character of the waterfall, have six poles, and a periodicity of 15 cycles per second. This entailed a somewhat higher cost as compared with the four-pole type, but enabled the pole cores to be fixed rigidly to the rotor hub. Some idea of the forces coming into play can be gathered from the statement that a wound pole shoe weighs 3½ tons, and with the fixing arrangement on the rotor hub is subjected at a normal speed to a centrifugal force of 343 tons. The generators are wound for a pressure of 3,000 volts, and the current is led to transformers by which the pressure is raised to 50,000 volts. Each generator and transformer unit forms an inseparable couple, so that no busbars or switches are provided

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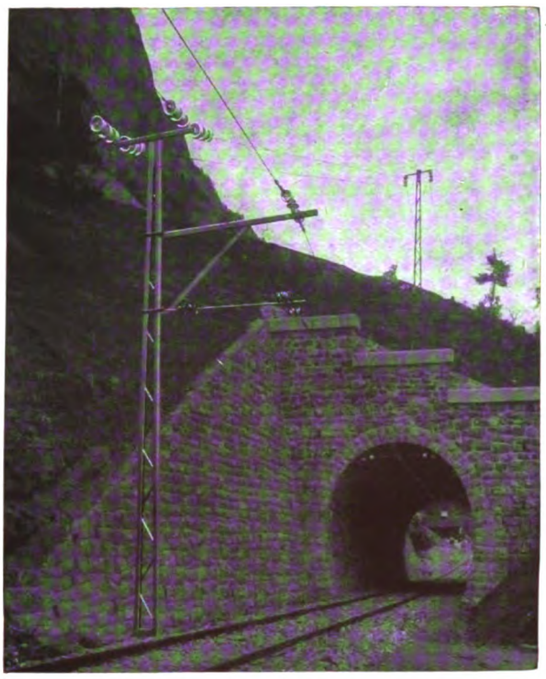
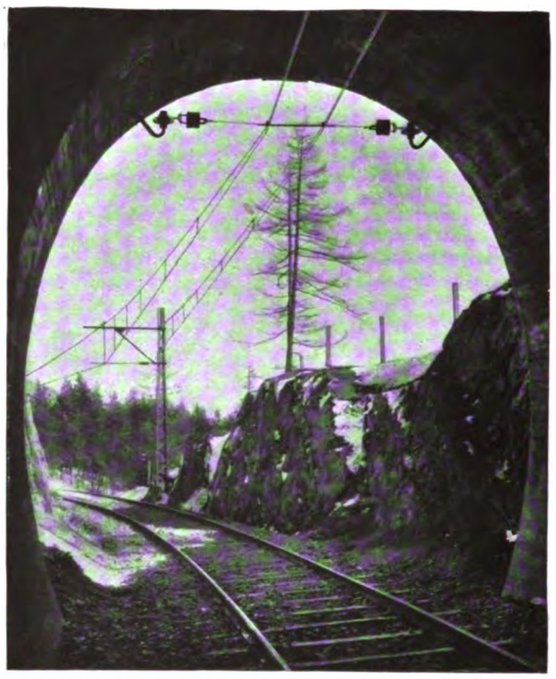
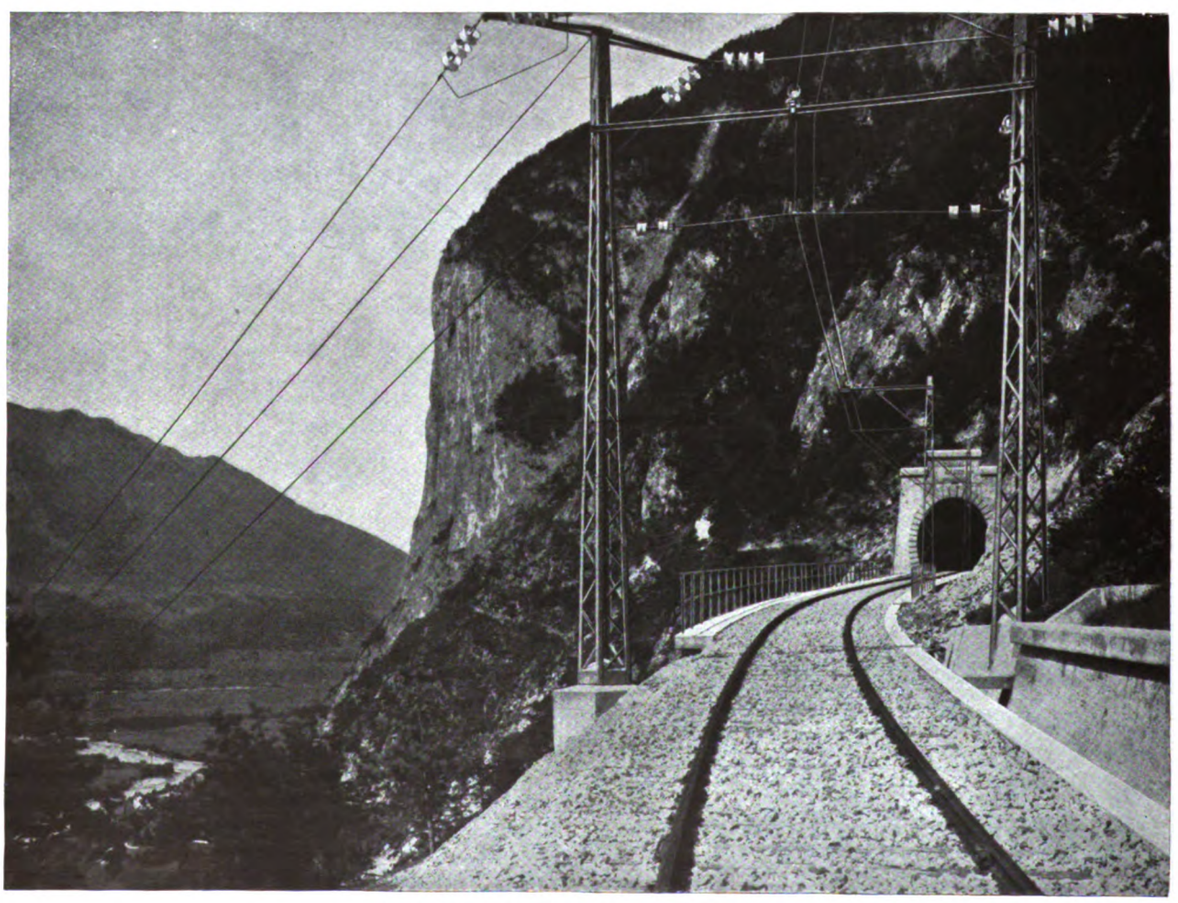


Transmission Line Carried Overground at a Tunnel on Separate Poles.



Suspension of Control Lines in Tunnel.

for 3,000 volts, all switches being placed only on the 50,000 volt side. The transformers are oil and water cooled, and are of the core type with disc windings, the wound core weighing 23 tons. The transformers are separately erected in fireproof cells. Each apparatus placed under a pressure of 50,000 volts is mounted separately in a cement cell, the ground plan being arranged so that in case of a breakdown the switchgear room may be entered from two sides without danger. All the switches have electro-magnetic remote control operated from the switchboard in the machine room. They are operated with automatic overload releases. The latter can be adjusted for a time limit, and are also arranged for hand operation.



Approach to a Tunnel on the Mittenwald.

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Sub-stations are situated at Reith, about 12 miles from the eastern, and at Chanz, about two miles from the western boundary of Austria. The transmission line is carried principally on lattice poles, which also support the overhead contact line. As a protection against atmospheric discharges a copper lightning wire is mounted upon the high-tension line at the top of the poles, and is earthed to the depth of the ground water at each pole. The lattice poles are placed 240 ft. apart, and the line is so constructed that every fifth pole will stand firmly even if the line breaks on one side. The intermediate poles are flexible. On the Innsbruck-Scharnitz section, a distance of about five miles, the transmission line is carried on a special row of poles, as the numerous tunnels on this section made it impracticable to erect the transmission wire on the trolley wire supports.

The transmission pressure of 50,000 volts requires, of course, very careful insulation, and a special type of link suspension was designed for the installation. The type was specially constructed for anchoring the contact line, which weighs only 6 lb. per insulator, and possesses a breaking strain of 17,000 lb. These insulators gave a test voltage in a dry condition of 50,000 volts. The grooves on the insulators are of round section, and for fixing steel bands are used which lie with their entire surface flat on the porcelain and do not injure the glass. The grooves were filled up to prevent the penetration of water and freezing. The insulators are provided with jointed fittings which take up all movement.

The catenary suspension is arranged without automatic tightening devices, as the continuous series of sharp curves entail much friction, and make it impossible for the customary tightening devices to work reliably.

When the Mittenwald Railway was first opened in 1912, nine electric locomotives were provided, each having a normal rating of 800 H.P. The locomotives were designed to draw a gross weight of 124 tons on the 3·64 per cent. gradient at a speed of about 20 miles per hour, but the machines are capable of much severer service. The locomotives weigh 53 tons. They are provided with two bow collectors with sliding contacts, by which the current is taken from the overhead line. It is then led through a bare high-tension conductor carried on the roof to a lightning-arrester choking coil, and thence to the transformer compartment, where it is connected up to the high-tension oil switch. This switch breaks the circuit at four points, and an auxiliary resistance is provided in order to reduce the stress set up on switching in the transformers. The oil switch is worked directly by means of the knife switch from the front driver's cab. It can be switched out from the rear cab by means of a press button which is connected through a resistance to the controlling current coil, and is switched in by means of an operating rod. Between the lightning arrester, choking coil, and the oil switch the earthing switch is inserted, which is closed automatically as soon as the protecting cover of the oil switch is removed. From the oil switch the current passes to the primary winding of the power transformer, and flows from here through the high-tension current transformer connected in series direct to earth. The secondary winding of this transformer feeds the maximum cut-out of the oil switch and two ammeters in the driver's cab.

The traction motors have a normal rating of 800 H.P. when running at a speed of 18·5 miles per hour, and are of the twelve-pole single phase commutator type. The regulation of the motor is effected by altering the voltage of the current supplied to it, which is done by means of contactors connected up to the lappings of the power and exciter transformers, and operated by the controlled current. The latter is taken from the special coil of the power transformer at a pressure of 300 volts, and is rated through a switch and fused to the master controller.

SOME RESULTS OF HEAVY RAILWAY ELECTRIFICATION.

Two papers read before the New York Railroad Club on March 16 last are of exceptional interest as giving some of the results obtained by electric traction with trains of very great weight. The application of electricity to such services is, of course, quite recent. Descriptions of the electric equipment of the two railways dealt with have already appeared in our pages. One is the Chicago, Milwaukee and St. Paul Railway and the other the Norfolk and Western Railway. The paper in regard to the former line was by Mr. R. Beeuwkes, electrical engineer of the railway, while that relating to the Norfolk and Western was by Mr. C. H. Quinn, chief electrical engineer of the undertaking.

The Milwaukee Scheme.

Mr. Beeuwkes, in his paper, stated that the Milwaukee and St. Paul electrified section, 440 miles in length, is in two operating divisions, one of which has been in service long enough to permit the collection of reasonably reliable data. The time in question is less than a year.

Harlowton, Mont., is the eastern terminus of the Rocky Mountain division, and the station where electric operation begins. Three Forks separates the division into east and west sub-divisions. Deer Lodge is the western terminus of the Rocky Mountain division. With the introduction of electricity the engineers were able to double the cruising radius of the locomotives. All locomotives run the entire 226 miles from Deer Lodge to Harlowton with only a very light inspection at Three Forks for bearings and pantagraphs.

Power consumption has been found on a typical day to vary from a maximum of 20,000 KW. to a minimum of less than zero at times when regenerative braking is taking place to a sufficient extent to supply all the railway demands and actually return some energy to the power company's supply system. How much this is is not known, as the curve-drawing meters do not register negative kilowatts. Under present conditions they are running with a monthly load factor—ratio average load to maximum load—of about 40 per cent., but expect within a few months to have installed a so-called power indicating and limiting system, which will automatically indicate to the dispatcher the exact amount of power which the whole system is drawing at any instant, and will automatically within certain limits hold the maximum down to a certain predetermined amount. This has the object of keeping as low as possible the maximum amount of power for which the railway company have to contract with the power company.

A comparison of passenger train delays for October, November, and December under steam operation in 1915, and electric operation in 1916, indicates the comparative reliability of service under the two systems. The passenger service consists regularly of two through, heavy, steel, eight-car trains each way per day, and one three-car local each way between Butte and Harlowton. The schedule time of the through trains under electricity is 40 minutes less than was that of the steam trains.

The records show a great decrease in operating delays. The dispatcher is better able to plan and predict train movements. This may be accounted for

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on the basis of less varying speed, lower number of freight trains for a given business, and fewer trains delayed. In the three corresponding months steam passenger trains waited for the right of way 1,910 minutes, as against 254 minutes for electric trains. Delays on account of extra heavy trains were only one-ninth as great under electricity as under steam. The electric engines handle ten or eleven steel cars on the 2 per cent. Piedmont gradient very comfortably.

In places the temperature is some times 50 deg. below zero for days at a stretch. It might have been expected that such low temperatures would result in many trolley and transmission troubles due to contraction of wires and cables, but the construction is particularly suited to such conditions, and they now have but little trouble on this account. The records for the three months in question show 445 minutes' delay to passenger steam engines and none to electric engines.

Electric engine failures have caused more delay than steam engine failures. There has been more trouble with electric motor bearings than the engineers expect to have ultimately, as there has been some difficulty in obtaining proper lubricant, and the packers have had to acquire new experience in handling the high-speed bearings involved. However, on account of regenerative braking there has been a marked reduction in waits to repair brake rigging and to change shoes.

Of the electrical troubles, exclusive of those on the locomotive, most are due to the pantagraph fouling the overhead construction, either because of the trolley wires or the track getting out of alignment or one track rail being low. Failure of power is practically negligible. The minutes of delay attributable to the electric system, outside of the locomotives, amount to about 8 per cent. The total minutes of delay is about the same for the two systems, but the number of trains delayed is reduced about 40 per cent. under electricity. Delays due to electrical features of the locomotives are comparatively slight, a rather surprising and gratifying fact considering the number of new features, such as the use of 3,000-volt direct current and direct-current regeneration, and that only a year ago the men operating these locomotives were all driving steam engines. The double trolley wire construction used has proved very successful, absolutely sparkless collection of current being obtained in all conditions of speed and amount of current. Twenty-six per cent. of the total minutes of delay was attributable to the electric system as a whole.

The accompanying table shows a comparison of locomotive performance for October, November, and December, under steam operation in 1915, and electric operation in 1916 :—

	Steam.	Electricity.
Passenger Service.		
Train or train engine-miles	119,330	119,237
Helper engine-miles	24,752	—
Number engines	13	7
Train-miles per engine	9,190	17,040
1,000 kw. hrs. at power company's meters	—	34,785
Kw.-hrs. per train-mile	—	29·1
Coal, total tons	11,260	—
Coal, lb. per train-mile	188	—
Freight Service.		
1,000 ton-miles	282,862	364,087
Train-miles	176,937	186,010
Helper engine-miles	56,363	20,157
Number engines	43	15
1,000 ton-miles per engine	6,745	24,260
Number trains	792	855
Ton-miles per train-mile	1,600	1,960
Total time, hours	17,825	14,535
Minutes per 1,000 ton-miles	3·78	2·39
1,000 kw. hours at power company's meters	—	14,343
Kw. hours per 1,000 ton-miles	—	39·4
Coal, total tons	39,050	—
Coal, lb. per 1,000 ton-miles	276	—

The number of passenger electric engines can probably be reduced when train heating apparatus is got into shape and minor electrical improvements completed. The number of steam engines on the other hand is a minimum. The electric freight engine handles about 3½ times as many ton-miles per month as the steam engine. The electric engine cuts 30 per cent. from the time to do a given business, partly by faster running and partly by heavier trains The tonnage of through freight trains is greater than is indicated, the average figures shown being considerably reduced on account of the comparatively light local freights that are included. The cost of electricity is considerably less than the sum paid for coal.

As to the effects of regeneration on the power consumption, for the month of November the amount of regenerated power measured at the locomotives was 11·3 per cent. of the total power consumed at the motors. Tests on a 2 per cent. gradient with a passenger train have shown a return as high as 42·8 per cent. The power-saving feature of regeneration, however, is not considered so important as the increased safety and ease with which trains are handled on the heavy mountain gradients, and the saving in wear and tear on the brake shoes and equipment.

The Norfolk and Western Case.

Mr. Quinn said that with the introduction of the electric locomotive on the Norfolk and Western Railway on January 1, 1914, the increase in speed of tonnage trains from seven to fourteen miles per hour up the gradient, as well as the prompt handling of these trains through the Elkhorn tunnel, had an immediate effect on the "keying up" of the entire traffic. With the exception of two through passenger trains, any of the electrically-handled coal trains can keep out of the way of any steam movement in the same direction on the gradient. The elimination of delay represents a very considerable improvement. Further, the absence of delays incidental to the taking on of coal and water for the three steam locomotives originally required on tonnage trains has not only materially reduced the running time but has removed cause for delays to other trains.

The characteristics of the type of electric locomotive used, permitting the maintenance of a constant speed of 14 miles per hour up grade, as well as the same speed characteristics in regenerating and holding to a constant speed the trains moving down, have enabled the telegraph operators, tower men, and dispatchers to figure very closely on these tonnage movements. The shortened time element, coupled with the absence of stalled trains and the reliability of the electric service, has eliminated the single-track tunnel at the summit of the gradient as a factor governing train movement.

A result is a marked reduction in the time necessary for the crews to get over the road. Under steam operation the average miles per day was about 60 per locomotive. For the electric engines this mileage has been increased to 100, with comparatively slight increase in time in service per day for the engine crew. As a result of this, as well as the short terminal time allowed the electric locomotive, it has been practicable to reduce the number handled out of Bluefield from 17 steam engines to five electric locomotives. The number of pusher engines on the ruling gradient has been reduced from seven steam locomotives to two electric engines.

A large part of the electric zone is through a narrow valley, with resulting encroachments from buildings, coal tipples, coke ovens, and the property lines of the mining companies. About 60 per cent. of the track is on curves, and there are 54 localities for switching

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movements from the main line. Fourteen miles an hour represents the maximum safe speed at which the heavy trains can be handled through this section. With this speed the company are enabled to double the rate at which the movements were made with steam locomotives. At a constant speed of 14 miles per hour the electric locomotive does not have any difficulty in keeping out of the way of local passenger trains and time-freight trains. The 28 miles per hour speed, which is used when double-heading passenger trains, as well as when handling the freight tonnage over the lighter gradients, has likewise proved very satisfactory. Over this latter section of the road the absence of mine operations and the comparatively few points where main line switching can take place, permit of the use of a running speed of 28 miles per hour for a 3,250-ton train.

With a fixed tonnage to be handled by the locomotives, the horse-power developed per locomotive corresponds directly with the speed. With a service requiring as much as 8,000 H.P. per train for accelerating, and a continuous demand of 6,000 H.P. per train for running at 14 miles per hour, it will necessitate the transmission of an equivalent amount of energy from the sub-station to the locomotive. The running speed at 14 miles per hour has worked out with great satisfaction, and even under 28 miles per hour operation and full load the working of the pantagraph current-collecting system has been eminently satisfactory.

The following table will verify the wisdom of the railroad company in its decision to instal the electrical system. The figures for 1914 represent the last complete annual period of steam locomotive operation, and those for 1916 cover the complete electric operation for that year.

	1914.	1916.	Per cent. change, + or −
Maximum east-bound tonnage for any 24-hour day—gross tons ...	51,226 ...	59,543 ...	+16
Maximum east-bound loaded cars for any 24-hour day	675 ...	757 ...	+12
Total east-bound loaded cars for year	132,618 ...	165,689 ...	+22
Total east-bound ton-miles for year (millions)	467 ...	592 ...	+27
Maximum number of locomotives required for heaviest day	43 ...	9 ...	−79
Total locomotive-hours required for year's business	93,625 ...	44,112 ...	−53
Normal number of locomotives in service	24 ...	7 ...	−71

It is doubtful whether the increased volume of traffic shown could have been successfully handled with steam operation if only for one day of 24 hours.

In general the cost of the electrification does not exceed to any great degree the value of such physical improvement to the road-bed and right-of-way as would have been necessary to put this division of the railroad in a position to handle the additional traffic with steam locomotives. The operating cost of the electric system is well within the original estimate. The ability of the electric locomotive to stand up under the heavy and exacting duties in pusher service, requiring the use of full power to hold the train slack while at a standstill, and to handle its rated tonnage according to the specifications, is being demonstrated in every-day service. The present rating of engine, after being in use for two years, is identical with the figures quoted in the contract. The electric engine has more than met expectations in the way of giving more engine-miles per 24 hours than was expected. Generally, the electric locomotive service has not only increased the capacity of the track at least 100 per cent., with a very conspicuous reduction in operating costs, but is likewise paying a return on the net cost of the installation. The installation is an engineering, an operating, and a financial success.

LONDON TRAFFIC AND THE FUTURE.

The problem of London's future planning and its traffic facilities is essentially one that demands continuous and unremitting study, and thus the work that is being done by such institutions as the London Society in this direction has a value which, in these times, may not be so fully appreciated as might be the case. The society's purpose is to encourage discussion and consideration of London's present and future necessities, so that its inevitable changes may assuredly be changes for the better. This was the need emphasised by Mr. Paul Waterhouse in a lecture delivered to its members a few days since on "London After the War."

The first occurrence, he said, which made him recognise this need was in 1905, when the report of the Royal Commission on London traffic was issued. It was even then made clear that something serious and important ought to be done to relieve congestion, and the matter had become increasingly urgent since. Reforms were pressingly called for, but it was of the utmost importance that they should be reforms upon the right lines. Referring to the trouble of congested thoroughfares, he felt that there had been a scarcity of ideas on this subject. People were far too apt to seek relief in one way only—by widening. Widening was by no means always a remedy. If a road was troubled with overcrowding, the cause might be not only that it was of itself of inadequate capacity. It might be that it was conveying traffic to an inadequate destination. This condition created a bottle-neck, and there could be no cure for that short of elimination. Bottle-necks might take various forms, and of these the concentration of roads at centres was the most common. They no doubt looked exceedingly nice on plans, but they gave great trouble to the police in regulating traffic. Crossings of more than four roads should therefore be always avoided, and it would be well if all the more important of such crossings were made on the "over and under" principle. It would be an advantage to make such crossings, wherever possible, at open garden spaces, rather than at points closely locked in by buildings, which involved structures of some times awkward proportions. A system such as this would greatly simplify the task of traffic control, and obviate much loss of time. He further recommended that all roads should bifurcate as they approached towns. This in itself was a corrective of the tendency towards over-concentration at centres; it relieved congestion by dividing the traffic just as it might begin to be heavy, and was convenient in that it gave people a better chance of reaching their destinations by the most direct and shortest route than was the case where they were limited to one road.

He then proceeded to deal with the railway problem, more particularly in relation to the oft-discussed proposition of establishing one great central terminus to accommodate all the railways running into London, superseding the separate stations now existing. He did not favour the idea, and proposed as an alternative a scheme of setting back the termini now within a radius of about 1½ miles from St. Paul's. This, of course, would comprise Charing Cross, Cannon Street, and Holborn Viaduct, but he was strongly of the opinion that these sites could be far better utilised for other than railway purposes. He was aware of the objections to the removal of these termini from the point of view of suburban traffic, but thought they could reasonably be met. But the central terminus project, although he knew many who were in favour of it, had many too serious drawbacks to commend as a practical scheme.

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American Electric Railways and War.

The American mail brings abundant evidence that as soon as the prospect of the United States entering into the war became definite the companies working electric street and inter-urban railways began to take precautions against possible German outrages. In 1914 many precautions were taken in this country, but in America the population of German birth or descent is immeasurably greater than it is in Great Britain, and this fact made imperative much more thorough protection. Moreover, there has been nearly three years' experience of the ways of the gentle Teuton when his country is at war. It is accordingly not surprising to learn that many of the electric railway companies placed armed guards round their power-stations and in many cases along their lines. The United States Secret Service appears to be very efficient and to have succeeded in carrying into effect the maxim that prevention is better than cure. But the owners of American electric railways are not being content merely to protect their own property; they have offered their assistance to the Government, and through a committee of the National Electric Railway Association are prepared to co-operate with the War Office in any plans that the latter may adopt. Already an organised scheme has been drawn up for the purpose of using the network of electric lines as auxiliaries in the mobilisation of men and munitions. Much useful patrol work can also, it is asserted, be done by electric cars, because there is a large mileage of these inter-urban and rural lines on the Atlantic seaboard. In these and other ways the country will now reap unexpected advantage from the wise and liberal policy which has been pursued in encouraging enterprise in electric traction.

Higher Fares Probable in the States.

One of the indirect consequences of the entrance of the United States into the war against the common enemy will probably be an increase of street railway fares. Experience in this country has proved that in many cases the pre-war scale of fares was too low to enable the undertakings to continue adequately to serve the public, and as a consequence various changes have been necessary. The great European struggle has had a financial influence in the States which resulted in the cost of most articles going up considerably. Dearer living means higher wages. These features will be much accentuated now that the United States is in the war, and it may be anticipated that the time-honoured five-cent fare for any distance within city limits will have to give place to a six-cent fare. The public in the great majority of cases will scarcely feel any hardship beyond the slight inconvenience that two coins instead of one will be required when making payment. When one remembers the graded fares in this country and the varying number of coins involved in making payment, it can hardly be doubted that the American people will easily be reconciled to the new charge. The financial difference to the electric railway companies, on the other hand, should be very considerable.

Fewer Stops.

As an expedient for enabling tramway managers to grapple more effectively with the present exceptional difficulties in maintaining car services more attention might well be given to

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the reduction of the number of stopping places. The suggestion has been discussed more than once in these columns, but except in a very few towns nothing has been done. Probably the fear of a public outcry has proved a sufficient deterrent; but a frank explanation of the extreme difficulty of maintaining even a diminished service ought to, and in most cases no doubt would, convince the public of the wisdom of the step. The economy that can be effected in time and material by eliminating a small percentage of the stops is considerable. In one important town the effect of cutting out 8 per cent. of the stops produced an appreciable saving of time and materially lessened the wear and tear on the rolling stock. Even with the cars in the hands of drivers of long service, who in time of peace can easily be given the advantage of periodical instruction, the starting and stopping of a car may be made a wasteful operation as regards energy consumption, the strain upon the equipment and the wear of tires. At this time of labour shortage the average efficiency of motormen cannot be maintained at the level reached in normal circumstances, and it is desirable to reduce the opportunities of the drivers for avoidable strain and wear and tear of the cars and equipment. That can be done to a considerable extent by reducing the number of stops. A moderate restriction will not entail hardship on passengers or appreciably affect earnings. When stopping places were adopted after the introduction of electric traction, the system was greeted by an outcry from those who were annoyed by not being able to board a car wherever they might be on the route, and who complained because they were asked to walk a short distance to a stopping-place. The public, however, quickly appreciated the real advantage of the system to them in reducing the time required for their journeys. That benefit would be increased, and tramway owners would also derive more advantage by still further curtailing the number of permissive stops. In view of the conditions under which traffic has now to be carried on there is no excuse for neglect to make use of every possible expedient that will effect economy or increase efficiency. The elimination of superfluous stops would do both.

Need for Co-ordination.

While the admission is general that the arrangements for public transit must be subordinated to the prosecution of the war, evidence comes from widely-separated districts as to the need for co-ordination among the Government departments upon which tramway and omnibus authorities are dependent. For a considerable period many tramways have been recognised as certified undertakings under the Munitions Act. The next step was to bring them under the Priority Branch of the Ministry of Munitions, which controls the supply of materials for the maintenance of cars, rails, and equipment. Of late, however, little advantage has accrued therefrom. Even undertakings that carry a large number of war workers appear to be scarcely better off than those concerned only with commercial or residential traffic. In the present state of affairs relating to the war on the sea and the conservation of the food supply, few tramways are more important than those of Belfast, with its great shipyards. Yet on April 25 the chairman of the Tramways Committee complained that car and other repairs had become impossible, with the result that difficulty is experienced in keeping a reasonable number of cars on the road. That was due to the War Office and the Ministry of Munitions holding the opinion that "tramways are not indispensable during the war"; consequently little or no assistance was received from those Government departments, although the undertaking was certified. Application for priority certificates for materials such as axles had either been refused or cut down to such an extent as to be valueless. Further, when certificates covering a small portion of their requirements were obtained, they had been nullified by the steelworks refusing to proceed with the order on the ground that their plant was employed on War Office and Admiralty work and could not be put on to anything else. This disclosure is not an isolated instance. Leeds, at the end of March, had nearly 100 cars standing idle for want of labour and materials to repair them. The experience of various tramways appears to indicate that the Priority Branch possesses no real authority. A similar statement may be made regarding the Transport Department of

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the Ministry of Munitions, which has been calling upon tramway authorities to remedy complaints regarding reduced services and unpunctual running while the War Office are concurrently taking away motormen. Many similar incidents could be cited, but one of the most instructive comes from Ilford, where a much used through service has had to be withdrawn while others have been reduced, the cause in each case being labour shortage. In his reply to the Ministry, the manager also stated that there are more motor omnibuses than are necessary, with the result that the tramways are being handicapped. Proof of this had been shown a few days previously at the county appeal tribunal, when the War Office representative claimed a dozen tramway hands, including six motormen, an armature winder, and an overhead linesman. To the manager's plea that any further reduction would necessitate a call on the rates, and that tramways ought to have a preference over omnibuses in a district where 10 per cent. of their passengers were munition workers, the military representative replied that the omnibuses reduced the need for tramcars. He had not the hardihood to suggest women drivers, as is now being generally done by War Office representatives at provincial tribunals. In one town the officer handed in the names of a dozen women who were ready to undergo tuition. No department ought to advise the employment of women unless the Government is prepared to avert trouble with the male employees. The War Office policy is the more remarkable in view of the inquiry which the Ministry of Munitions recently instituted among tramways as to the number of women who would be required in the event of eligible motormen being called up. Another disquieting feature is that when a company withdraws a purely civilian service in order to utilise the cars for war workers, the Government leave them to be worried into restoring it, although one cause of the withdrawal may be the helplessness of the munitions department to provide materials for the upkeep of the cars. As far as these handicaps can be mitigated the remedy would seem to lie in co-ordination at Westminster.

TRADE AFTER THE WAR.

Imperial Preference Assured.

In the House of Commons on April 27, in reply to a question, Mr. Bonar Law was able to make this brief but portentous announcement :—

"The Imperial War Cabinet has unanimously accepted the principle that each part of the Empire, having due regard to the interests of our Allies, shall give specially favourable treatment and facilities to the produce and manufactures of other parts of the Empire."

This statement was supplemented by the information that as Australia has not been represented at the Imperial Cabinet she is not a party to the resolution. No one, however, can doubt what attitude her Government will take, and it must be a source of regret to Mr. Hughes, the Premier of Australia, that through the exigencies of internal politics the island continent was unable to send representatives to join in the epoch-making determination. Mr. Bonar Law, in answer to further questions, stated that there is no intention of making any change during the war, and that the resolution does not involve the taxation of food, that question being left open. In regard to the former of these two points, it would probably not be practicable to go into the complicated and still controversial questions of tariffs while the war is going on, but the great point has been achieved that the principle has been accepted. In regard to the latter of the two points, the Prime Minister, Mr. Lloyd George, stated on the same day, in his speech at the Guildhall when he received the freedom of the City of London, that the Government do not propose the taxation of food. There is, indeed, no necessity in these times for contemplating anything of that sort.

It is singular to reflect that Mr. Bonar Law's announcement, so important in itself and marking the conclusion of a long struggle, should have been received as quietly as it was made. There was no heated political arena. The House of Commons was holding a Friday sitting for the discussion of some Bills which, though important in themselves, do not evoke a widespread, burning interest. There was only a small attendance of Members. The questions were quietly put and as quietly answered; there were no cheers nor voices of dissent. Truly when it comes to practical affairs we are a wonderful people.

An Imperial Economic System.

On April 27 was published a memorial presented to the Imperial War Cabinet by the British Empire Producers' Organisation on behalf of organised industries of the Empire. The importance of the memorial can be judged from the fact that it is signed by 81 associations of producers and manufacturers, representing, it is believed, about £1,000,000,000 of capital. The industries represented are distributed throughout the Empire. The memorial sets out a number of principles, the more important of which may be briefly indicated as follow :—The first claim on Imperial statesmanship is that remunerative employment shall be made available for all. To this end production, capital, labour, and science should be systematically directed towards the development of the boundless resources of the Empire. The resolutions of the Paris Conference provide a sound basis. After the institution of such a system of reciprocal preferential arrangements as will give effect to the resolutions of the Paris Conference, our next Imperial duty is to stimulate the employment of available resources of mechanical and chemical science. The system of education should be thoroughly revised.

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The State should recognise and regularise the position of industrial organisations, and give them additional responsibility. In conference with each other, with labour, and with the Government, they may thus found a system of industrial security and progress.

These far-reaching principles are recommended as a basis for an Imperial economic system. They focus many of the incipient aims of to-day, and no more favourable time can be found than the present and the near future for carrying them out. The Producers' Organisation deserves the thanks of the Empire for its wise action.

Sir Albert Stanley and National Trade.

Sir Albert Stanley, President of the Board of Trade, in an address to the members of the Aldwych Club on April 26, said that he had definitely come to the conclusion that if our past methods were continued we should fail to hold our place in the front of business countries. The following abstract of his further remarks contains both significant information and advice :—

It was not many years since this country produced 60 per cent. of the steel of the world, but in 1914 Germany produced 85 per cent. more pig iron and 143 per cent. more steel than was produced here. For spelter and copper we were entirely dependent upon Germany, which had then established such a hold upon the non-ferrous metals of the world that we found ourselves dependent on her even for the statistical information to guide us in determining new sources of supply. They had secured a control which had meant to this country during the war the loss of tens of millions of pounds and thousands and thousands of brave men. The dyeing industry was worth £2,000,000 a year. The great textile industry that depended on dyeing was worth more than £100,000,000, and yet at the outbreak of war we were dependent almost entirely on Germany for dyes. Governments in the past had failed to take into account that this was a commercial era, and that the efficient conduct of the great industries of this country was vital to its welfare. Governments from now onwards would take an infinitely greater interest in industries, and would make it their business to see that they were carried on properly and efficiently, and see that we were not dependent on any foreign country for any essential commodity. The foundation of our industrial success was an efficient system of education. But education in business did not end with the school and the University. The young men must be familiarised with the methods of competitors and must travel. Business men must not be afraid to exchange ideas with their competitors. If they found that small undertakings could not exist in competition with the great combinations of other countries they must adapt their methods to the altered conditions. All that we were fighting for to-day would not be worth while if afterwards there was no desire to continue the fight for commercial supremacy. Competition in the years to come would require all the ingenuity, foresight, courage, and resourcefulness of every man in the country.

The Trade Bank.

It is gratifying to observe that effective steps are being taken for the formation, in accordance with the proposals of Lord Faringdon's Committee, of a trade bank, which is to be devoted to the granting of financial facilities to manufacturers for the development of overseas business and to the collection and communication of information for manufacturers and traders. The bank will, in some directions, be wider in scope than ordinary banking institutions, and it is fitting that its title should be the British Trade Corporation. It had become known that the scheme under the ægis of the Government was afoot, and on April 26, in the House of Commons, the official announcement was made. Mr. George Roberts, Parliamentary Secretary to the Board of Trade, then stated that the Government had promised the British Trade Corporation their sympathy and support. The Corporation had received a Royal Charter establishing it for a term of 60 years, and clause 4 of the charter conferred on it the right, under certain circumstances, to act as agent of the Government, subject to the Government being entitled to appoint other agents in any special case in which such a course might appear necessary or expedient. The Corporation had been brought into being with the object of assisting British trade and industries, and failure on the part of the Corporation to give effect to that object would expose it to the liability of proceedings being taken to annul the charter. The Corporation were also under terms to remain British in character and free from foreign control.

Lord Faringdon himself is taking a leading part in the formation of the new institution, and industry and commerce will be fully represented on the board of directors. To promote British trade and to counter German banking and business machinations, preference will always be given to orders to be executed in this country. The Information Bureau, which will form an important part of the scheme, will examine new projects on the scientific and technical as well as on the financial sides. It will be an intelligence office for facts relating to foreign trade obtained through the Corporation's agencies in many of the principal countries of the world. The Board of Trade's Commercial Intelligence Department will be in close touch with the Information Bureau, and give all possible assistance. It is hoped also that the Corporation will investigate the prospects and *bona fides* of new industrial schemes. Thus it is that we are beginning to evolve organisation which is so much needed.

WAR PROTECTIVE MEASURES BY AMERICAN ELECTRIC RAILWAYS.

Reports from Ten Cities.

The first concern of the electric railways in the United States subsequent to the war message of President Wilson has been to insure uninterrupted service to the communities which they serve. A canvass of some of the principal electric railways and combined railway and lighting companies by the *Electric Railway Journal*, of New York, in the principal cities, shows that the extent of the precautionary measures taken by the companies to guard their properties has depended very largely on the degree of their vulnerability to injury by the enemy or their agents.

Sharpshooters and Barbed Wire.

In one city National Guard sharpshooters have been stationed at the electric generating and distributing stations, and 6 ft. barbed wire entanglements have been constructed around the power houses. All car houses of this company and of an inter-urban line running out of the city are under special police protection, but no application has been made by the street railway officials for authority for military protection. Along the local and inter-urban lines the high-power transmission systems are being guarded by deputy sheriffs in the localities through which the transmission lines pass.

Somewhat similar measures to those have been adopted by a company on the Pacific Coast. This company for the last month has had thirty-six employees formerly in the army or the National Guard clothed with deputy sheriff authority to guard the hydro-electric plant and important sub-stations day and night. These guards were supplanted on April 4 by Federal soldiers. Some time ago elaborate flood-lighting systems were installed at all the hydro-electric plants to protect the pen stocks and the plants themselves. No unusual precautions have been taken to guard the transmission lines, the track, bridges, or car houses, aside from the regular employees whose duties cover the company's property.

The inter-urban railways in one of the lake cities have strengthened the service of their watchmen and put guards on some of the bridges. The power houses of these companies are operated in the usual way, and are not flood-lighted. The staff of watchmen at the power houses of the city railway there has been strengthened, but no legal guards or others have as yet been employed. Care is being exercised in the issue of passes to inspect the power plants. The power-station of the local electric light company, however, is flood-lighted.

In another city in the same geographical group of States as one of the other companies mentioned the city railway has adopted no extra precautions with respect to the bulk of its property. The transmission lines coming from another State are being protected by militia day and night, but the tracks are not being patrolled. The car houses of this company are protected even in normal times and no extra guards have been employed, and no arms or legal authority have been vested in the employees.

At an important inter-urban centre in the Middle West it had not been deemed necessary up to the time of writing to adopt any precautionary measures other than those used regularly to safeguard the properties and protect them against any interruptions to service.

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COMPANIES ADDRESS THE CITY.

Some time ago the railway corporations in a south-western city addressed a communication to the City Council outlining the arrangements made by them to share in the national defence plans. They announced then that the transportation facilities of both railways would be placed at the disposal of Government agents, and further said that all employees had been instructed in the part which they would be required to perform if the Government called upon them for service.

At New York City two notices were issued by the Interborough Rapid Transit Company, bearing upon the present national crisis. They are of the same tenor, and urge caution against possible plots to upset transit. One of the notices said:—

"The gravity of the national crisis is such as to require that every employee, whether on the elevated structure, in the subway, the shops, the power houses, or the offices, should maintain a constant vigilance in the discharge of his duties, to detect irregularities of any kind whatsoever, and promptly report the facts in person or by telephone to the head of his department."

WHOLE SYSTEM TO BE PROTECTED.

Another system in the East is now organising a force of guards, and installing protective equipment to cover the whole system. In general, guards are to be placed at strategic points, such as the portals of tunnels and at power houses. Full police powers have been requested for them, and if these are granted the guards will be classed as special policemen entitled to carry arms and to make arrests. Exterior lighting at night will be provided for power-stations, and guards will be stationed at points where the lighting is ineffective. Sub-stations will be guarded by the attendants. For the car houses the fire system watchmen normally employed together with the regular exterior police protection are deemed sufficient. No special patrolling of track or transmission lines, aside from that regularly employed, is to be inaugurated, except that, as before-mentioned, guards will be stationed at such places as are considered danger points.

ONE HUNDRED ARMED MEN ON GUARD.

In a city of the Middle West 100 armed men of a company of the State National Guard under War Department orders patrol the river fronts day and night, guarding the central and other power-stations of the railway. Men of this detachment also guard the bridges, track, and transmission lines. Extra militiamen have been placed on the bridges used by one of the inter-urban lines entering the city. When the militia is called upon to leave, guards will probably be employed under department orders. The power houses are kept lighted. No other protective measures have been taken by the companies except the use of the usual section gangs and watchmen. The company of the militia which is doing this patrol duty is composed almost wholly of employees of the local city railway.

SPECIAL OFFICERS IN USE.

In one city in the south-west armed guards with commissions of special officers are being used to protect the power-stations of the city railway by day and by night. The plants of one of the inter-urban railways there and the plant of the local light and power company are also being guarded. Tracks are not being patrolled except by track gangs, but these men have instructions to exercise extra precaution. Still another company operating in the city is also guarding its power plant by day and by night, but the tracks are not patrolled except by regular track workers.

AMERICAN ELECTRICAL INDUSTRIES READY TO SERVE.

The Electrical World, of New York, publishes among other messages the following from Mr. E. W. Rice, jun., president of the General Electric Company:—

"The President's message expresses in simple but powerful words the solemn and final judgment of a great peace-loving people on the issues of this great war.

"While every thoughtful citizen must realise the gravity of the step which we are now taking, there will be no holding back, and no matter what trials the future may have for us, the knowledge that we are fighting in defence of all that makes life worth living will enable us to persevere until victory for ourselves and our natural allies has been obtained.

"Men of the electrical industry, representing every phase of scientific and engineering activity, will be able to render invaluable service, as a modern war, as is well known, cannot be won by courage and strength alone, but demands skill in control of complicated machinery and the use of scientific methods all the time and everywhere.

"This is not a war between peoples, but a mighty conflict of irreconcilable ideals of government and of life, and there can be no question, therefore that every citizen of this country who treasures our ideals will welcome the solemn privilege, which has been forced upon him, of fighting for them. We all devoutly hope and believe that the entrance of our nation on the side of liberty and humanity will bring to a speedy end this terrible scourge of the world.

"Schenectady, April 4, 1917." "W. E. RICE, Jun."

OVERTURNING OF A CAR AT WIGAN.

EXPERTS' EVIDENCE IN AN ACTION FOR DAMAGES.

A test case for damages for injuries sustained by the overturning of a Wigan Corporation tramcar on July 26, 1916, was decided in the County Court by Judge Spencer Hogg on March 27 and 29, when Mary Sanderson claimed £45 for injuries arising from alleged negligence on the part of the Corporation in allowing the tramcar to be overloaded, driving at an excessive speed down an incline, failure to maintain the car in proper order, and failure to maintain the tramway track in proper order.

In opening the case, Mr. Jackson, barrister, said the car was a very old one, the Corporation having, he understood, purchased it in 1901. The top cover, which was afterwards added, to a certain extent lessened the stability of the car. It ran on the narrow gauge of 3 ft. 6 in. It had accommodation for 22 persons inside and 26 on the top deck. When it left Library Street at 10.15 p.m. it had 24 passengers sitting inside, 12 standing inside, 8 and the conductor standing on the rear platform, three or four on the rear staircase, and four on the motorman's platform. The top of the car was also crowded, and instead of there being a total of 48 passengers, there was a total of 74. The car started with a very sudden jerk. The gradients of the route varied from 1 in 8 to 1 in 22, the average being 1 in about 20. At the loop the car seemed to have taken the turning to the left at the first point, and on getting to the second point it seemed to have jumped the points altogether, swung out to the right, and fallen on its left side. About thirty people were injured and one killed. Plaintiff and three other persons stood at the front of the car near the driver. She went to get on at the rear end, but the conductor told her it was too full, and asked her to go to the front. The Board of Trade speed limit was eight miles an hour, and four miles an hour entering the crossing, and he thought his Honour would have no difficulty in finding that the driver drove this car at a speed which exceeded that.

Mr. Thomas Davies, expert adviser to Liverpool Corporation Tramways Committee, deposed to examining the car after it had been dismantled and only allowed a partial examination. The wheel base of the Liverpool standard car was 8 ft. against 6 ft. in the case of this car. Formerly they had 6 ft. wheel base in Liverpool, but after a car had turned over this was changed to 8 ft. He found the near rear wheel was 1¼ in. out of alignment, and the rear off wheel three-eighths of an inch out of line. At the crossing plate the tongue had been torn away and burred up, and in that condition it would be a fruitful source of derailment given other conditions. That day he had found that the burred up and torn condition had been put right. He noticed three other distinct signs of derailment. This car was palpably lacking in initial stability.

By Mr. Gibbons: His opinion was that the car went over the facing point, and after going thirty feet derailed at the crossing. He did not know that the consent of the Board of Trade was got to dismantle the car if necessary. The front wheels, in consequence of the defect in the flanges, were in the worst condition in which he had ever seen wheels.

For the defence, Mr. Gibbons, K.C., said great stress had been made on the alleged overloading, owing to which it was contended that the hand brake was insufficient to hold the car going downhill. Counsel maintained that the evidence of plaintiff's witnesses showed that the brake reduced the speed. According to a police sergeant who gave evidence, the speed was the ordinary speed of four or five miles an hour. Though the car was able to carry the number of passengers suggested by the plaintiff, there were not nearly so many on the car as was asserted.

Among the witnesses called for the Corporation was Mr. Fred Bland, director of the tramways department, Messrs. Edgar Allen and Company, Sheffield, makers of points and crossings. He said he examined the points and crossing after the accident for the purpose of the inquest, and he found them in perfect working order, and they were as good a type of crossing as it was possible to get. His firm did not make these points and the crossing.

The motorman said he became a driver in 1914. There was always a slight jerk when he started downhill. He cut off the electricity and controlled the car at five miles an hour with the hand brake. At the loop he reduced to four miles an hour, just before he entered the points. The car turned in the wrong direction at the facing points, and he did his best to pull up. He could only account for the car not taking the points by a shower of rain having caused sand or dirt to accumulate, thus preventing the spring working.

The conductor, in reply to the Judge, said the car was overloaded to a certain extent. He had not seen any rules to say that no more than the proper number of passengers should be carried, but if the car was full he could refuse to allow more to board it. Passengers were not allowed to stand on the platform, and if he saw anybody there his duty was to order them to go inside or upstairs, or go off.

Mr. Alfred Baker, general manager, Birmingham Corporation Tramways, said that Birmingham had the narrow gauge, and of the 500 or 600 cars running daily 130 of them were identical with this Wigan car, except that the Birmingham cars, with the same 6 ft.

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wheel base, were about 1¾ in. higher and carried two additional passengers. At the scene of the accident the track, rails, points, and crossing seemed to be in excellent condition. The entrance to the loop was an easy one. He could see no evidence of part of the diamond crossing having been torn away or burred, as stated by Mr. Davies. It was of manganised steel, and a man could not take a hammer and chisel to repair it; it required a grinding machine. The flanges of the wheels had a good deal of life in them. In Birmingham they had run flanges down half-way. The makers of tires allowed an eighth of an inch wear for 5,000 miles' running. There were no signs that the car skidded; had it done so there would have been flat places on the tires. Mr. Davies could not say whether the car wheels were in alignment from the position it was in when he examined it. The brakes had plenty of life in them, although worn. The driver would not have time to apply the slipper brakes in the distance he travelled.

Mr. S. C. Laws, Principal of Wigan Mining and Technical College, submitted calculations showing that overloading on the rear platform would have the opposite effect as regards a lifting movement on the front wheels to that submitted in support of plaintiff's case.

By his Honour: Two cars on parallel lines proceeding down an incline, one with a 10 tons load and the other 12 tons, would reach the bottom in the same time.

Mr. J. A. Panton, consulting engineer, Liverpool, said the track, points, diamond crossing, and car were in good condition. The wheels were exactly in gauge, and the flanges were worn, as might be expected, an eighth of an inch after a 5,000 miles' run. The wheels were fit to run. There was ten or fourteen days' more life in the brake-blocks produced, which were sufficient to hold a car, even if overloaded, on this gradient. There were many cars running in Liverpool which had only a 6 ft. wheel base; the extension of the cars was made for the purpose of increasing the seating accommodation, and not because a car overturned. He had not been able to follow Mr. Davies' argument that the overloading on the rear platform would cause a tilting up.

Mr. A. T. Gooseman, borough engineer, said the gradient was 1 in 20·73. The points, crossing, and track were in good condition. There were marks where the car came off near the facing points. It was impossible for a car to leave the track and turn over in the space between the diamond crossing and where it did overturn. The marks which were said to indicate previous derailments were due to the car being twisted round to get it on the rails again.

By his Honour: In his opinion some foreign substance might have got into the groove and caused the car to leave the track.

Mr. J. Prescott, permanent way foreman, deposed that the points were cleaned every morning, and Mr. W. W. Owen, depot foreman, said he drove the car back to the shed, and it passed through several points and loops without any difficulty.

His Honour ruled that the allegation with reference to the track being defective had not been proved. He had no hesitation in finding that there was overcrowding, so much so that the brakes were not sufficient, or were not sufficiently used to meet the extra speed caused by the extra weight on the car. Consequently the car went down the gradient at an excessive speed and left the line. He also found that the car had not been kept in proper order, and he therefore allowed judgment for £15 and costs on the higher scale.

A stay of execution was granted.

Wigan Jury and Car Loading.

On April 19 the Wigan coroner investigated the circumstances attending the death of a man who was injured by a car running away down the hill at Plantation Gates, Whelley.

The conductor stated that the car was registered to carry 48 passengers, but on this occasion there were 73. He had not had any written instructions with regard to overcrowding; inspectors had from time to time seen that there had been overcrowding, and had issued no warning. He had carried more passengers on various occasions.

Mr. J. A. Panton, consulting engineer, and formerly for eight years assistant manager of Liverpool Overhead Electric Railway, said he tested the car, and found it satisfactory. The braking effect on a car was 30 per cent. of its weight at any time, and if a car carried 73 passengers, or only seven, the effect would be no different up to a point of ten tons, which was the full brake-power. If the brakes had been defective the car would not have negotiated declivities of 1 in 12 and 1 in 14, which was the ratio in the other inclines on the route. The driver had insufficient brake power on at a particular point on the incline, and that meant that the car began to travel at an excessive speed. When he put the brake hard on it caused the wheels to skid, and finding that did not hold the car he tried the electric brake, but that failed because the wheels were skidding.

In finding a verdict of accidental death, the jury exonerated the driver from blame, but they added a rider that it was not in the interests of the travelling public that the overcrowding of cars should be allowed to take place, and measures ought to be taken to stop it.

Orrell Urban Council have called the attention of the Corporation to the danger of overcrowding on the cars.

BRAZILIAN TRACTION, LIGHT AND POWER COMPANY.

In view of the numerous inquiries which have recently been made with reference to the financial policy of the Brazilian Traction, Light and Power Company, Limited, the directors on April 19 issued the following statement to the shareholders:—

The revenue derived from the operation of the enterprises in Brazil has shown each year, since the incorporation of the company, substantial gains, as will be seen from the following figures:—

Year ended December 31 ...	1915. Milreis.	1914. Milreis.	1913. Milreis.
Gross earnings from operation in Brazil	77,119,208	73,184,714	71,911,974
Net earnings from operation in Brazil	44,176,866	41,879,569	39,312,729

The decline in the surplus available for dividends, as compared with the year 1913, is due almost wholly to the fall in the exchange value of the milreis, which for some years before the war was maintained at slightly above 16d. During the last half of 1914, the rate averaged approximately 13d., and during the last two years slightly over 12d. The consequence is, that notwithstanding that the gross and net earnings during the past two years have been greater than at any previous period, the net earnings from operation, when converted into Canadian currency, are actually much less than they were before the war.

The following figures show the net revenue of the company in gold for the past three years, with the approximate rate of exchange prevailing in the several periods:—

Year ended December 31 ...	1915.	1914.	1913.
Approximate rate of exchange	12d.	15d.	16d.
Revenue of the company (Canadian currency) after payment of all fixed charges	$5,612,876	$8,058,813	$8,420,560
General administration expenses, including interest	218,074	392,281	308,296
Balance net revenue available for preference and ordinary dividends	$5,394,802	$7,666,532	$8,112,264

The annual accounts for the year 1916 are not yet completed, but the gross and net earnings in Brazilian currency from operation (subject to audit) have exceeded those of the previous year by 7,823,000 milreis and 2,307,000 milreis respectively, notwithstanding the abnormal high freights which on coal increased from 15s. per ton before the war to as high as 80s. per ton last year, and it is estimated that the net revenue of the company for the year, after payment of all fixed charges and expenses, will be approximately $5,054,000 (at exchange about 12d.), or $250,000 in excess of the net revenue of the preceding year, but $2,458,000 less than the net revenue of the year immediately preceding the war.

If the rate of exchange prevailing before the war had been obtainable, the net revenue, in Canadian currency, for the year 1915 would have been increased by over $3,000,000, and for the year 1916 by over $3,300,000, so that the surplus net revenue for these two years would have been increased by the sum of $6,300,000, an amount more than sufficient to discharge the present floating indebtedness of the company and its subsidiaries.

The report issued to the shareholders in August last of the operations of the company and its subsidiaries for the year 1915 sets forth the financial position as on the 31st December, 1915.

Since the date of that report the company has issued and sold in New York $7,500,000 6 per cent. 3-year notes, and a portion of the proceeds has been applied in discharging the temporary loans raised in connection with the acquisition of telephone properties in the City and State of Sao Paulo, which, if the war had not intervened, would have been provided in the usual way by the sale of funded securities. The balance of the proceeds of the notes, namely, $2,000,000, is being used for the development of the telephone undertakings, and this expenditure should result in a considerable increase in the revenue, which even now is more than sufficient to meet the interest on the notes.

Early in 1914 the Board decided to extend and consolidate its telephone system by the acquisition of the further properties referred to above, and assumed the obligation of the extensions now in progress. Negotiations for the sale of a bond issue, to provide the necessary funds, were in progress when the war made the proposed financing impossible. As a result the company was forced to continue with its bankers the temporary loans above referred to, which have now been liquidated.

In the ordinary course these notes will be taken care of by an issue of bonds secured on the telephone properties.

The physical properties in Brazil have been maintained in a highly efficient state, but in addition to the maintenance of the property

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it is necessary in each year to expend on capital account considerable sums for extensions and improvements. These, during the last three years, have amounted to $8,600,000, and it is estimated that in the year 1917 the sum of $1,700,000 will be required.

Under normal conditions this would have been provided for by the sale of the company's securities, the interest on which would have been met by the increased earnings derived from such expenditure, but, owing to the abnormal conditions arising from the war, it has been necessary to meet this capital expenditure, so far as same has not been paid out of earnings, by temporary loans, with the result that the floating indebtedness of the company and its subsidiaries, including the amount owing in respect of interest coupons and dividend warrants due but not presented for payment since the outbreak of war, at 31st March amounted to $4,850,000.

The amount required annually for a dividend on the preference share capital of the company is $600,000, and for a dividend on the ordinary share capital of the company at the rate heretofore paid (viz., 4 per cent.) is $4,250,000, making a total of $4,850,000, which sum, deducted from the estimated net revenue, leaves only a relatively small balance available. It will therefore be seen that, so long as the company continues to pay a dividend on its ordinary share capital and exchange remains at approximately its present rate, it will not be possible to provide sufficiently for the necessary capital expenditure and to reduce the floating indebtedness.

The Board have therefore decided not to pay a dividend in June next, and propose to continue this policy throughout the remainder of the year, unless there should be such improvement in exchange as to justify the resumption of the dividend at an earlier date.

LEEDS CORPORATION TRAMWAYS.

The Leeds City Tramways have had a notably successful year, and the ratepayers have much reason to be gratified with the excellent report that the general manager, Mr. J. B. Hamilton, has again been able to present. After providing for all charges, including sinking fund payments and £30,000 for renewals of permanent way, there is a net surplus of £79,431, an increase of £7,610 as compared with the previous year's result. Receipts at £515,806 show an increase of £40,301 over the previous year, and of £104,275 as compared with the last pre-war year, as will be seen from the appended table, which includes that year and the four following years:—

Year ended March 31 ...	1917.	1916.	1915.	1914.	1913.
INCOME—					
Traffic revenue	£507,755	£467,197	£429,803	£423,516	£407,551
Advertising	2,943	2,620	3,915	3,822	3,662
Mineral haulage	1,397	634	--	--	--
Rents	3,711	5,054	121	117	95
Discounts	--	--	--	--	223
	£515,806	£475,505	£433,940	£427,455	£411,531
EXPENDITURE—					
Traffic	£122,499	£114,724	£115,601	£113,819	£109,413
General	39,832	41,190	40,347	41,144	36,055
Repairs and maintenance ...	53,291	42,786	43,699	41,020	39,894
Power expenses	23,027	16,837	14,035	24,345	24,700
Energy purchased	12,070	15,178	14,542	6,054	3,755
War bonus to employees ...	10,766	5,512	--	--	--
	£261,485	£236,227	£228,134	£226,382	£213,817
Balance	£254,320	£239,278	£205,805	£201,073	£197,713
Bank Interest	2,379	4,413	1,344	2,675	2,283
Dividends on investments ...	7,377	5,867	6,493	5,679	5,228
	£264,076	£249,558	£213,642	£209,427	£205,224
Interest on property	£3,343	£3,218	£2,647	£2,784	--
Interest on capital	49,777	49,444	44,527	42,177	42,197
Income-tax	17,847	15,349	7,357	5,344	5,020
Rent of lines	3,018	3,071	3,125	3,223	3,217
War allowances	12,890	13,272	4,460	--	--
Balance	177,201	165,204	151,526	155,898	154,790
APPROPRIATED AS FOLLOWS—					
Redemption fund	£64,205	£72,489	£57,773	£53,914	£49,923
Cost of Acts	445	703	258	403	403
Renewals	30,000	3,146	11,928	31,576	41,752
Contribution to capital outlay	2,373	--	--	--	1337
Third party risk reserve ...	747	2,044	--	--	--
Reserve fund	--	15,000	--	--	--
Net surplus	79,431	71,822	81,567	70,004	61,375

Coal Carriage by Tramways.—The Sanitary Committee of Leeds have asked the Tramways Committee whether the departments can arrange to carry the isolation hospitals' coal supply on the tramways. The department possesses a number of tip-wagons which are used to convey fireclay for a local company, and the profit from this work has more than doubled during the past year. Last winter the Corporation decided to purchase several motor lorries for the conveyance of fuel to the schools and hospitals, owing to the shortage of horses.

FINANCIAL REPORTS AND MEETINGS.

Lima Light, Power, and Tramways Company.—A dividend of 1¼ per cent. (less income-tax) has been declared.

Sao Paulo Tramways, Light and Power Company have declared a dividend of 2½ per cent. on the common stock.

Huddersfield Tramways Committee have voted £8,800 to the relief of the rates, which is equivalent to a fourpenny rate.

Edison Swan Electric Company, Limited.—At a special meeting of shareholders in London on April 5, the issue of 100,000 Preference shares was sanctioned.

West Ham Corporation anticipated a loss of £15,500 on the tramways and electricity undertakings for 1916-17, owing to the increased working costs, etc., resulting from the war.

Auckland Electric Tramways Company.—The directors have declared an interim dividend of 7d. per share, less income-tax, on ordinary shares for the year to June 30 next.

Bombay Electric Supply and Tramways Company, Limited.—The directors recommend a dividend on the ordinary shares at the rate of 10 per cent. for the year ended December 31, 1916.

Rothesay Tramways Company.—The receipts for the year were £9,589. A dividend of 5 per cent. on preference shares is proposed, adding £600 to the reserve, and carrying forward £140.

City of Buenos Ayres Tramways Company (1904).—A dividend has been declared of 1s. 3d. per share, or at the rate of 5 per cent. per annum, less tax, for the three months ended March 31. The rate is the same as a year ago.

Barsi Light Railway.—The directors of the Barsi Light Railway Company have declared an interim dividend of 3 per cent., together with a bonus of 1 per cent. (8s. per share in all) in respect of the year to 31st inst., payable on April 27.

Carthagena and Herrerias Steam Tramways Company.—The receipts in 1916 were £30,501, expenses £24,084, and net revenue £6,416, while £1,371 was brought forward. After providing for debenture interest, £1,789 is carried forward.

La Plata Electric Tramways Company.—The accounts for 1916 show a credit balance of £10,048, which has been carried forward. A sum of £3,000 has been added to the reserve fund, bringing this up to £7,000. The previous year the carry forward amounted to £12,142.

Vickers, Limited. A final dividend for the year 1916 of 1s. 6d. per share, free of income-tax, on the ordinary shares, making 2s. 6d. per share, or 12½ per cent. for the year, has been declared. The rate of distribution is the same as for the preceding three periods.

Oldham, Ashton and Hyde Electric Tramways Company.—The report for 1916 shows revenue amounting to £37,008, and expenditure (including £1,504 for debenture interest and £1,500 placed to provision for renewals account), £25,504. The net profit was £11,503, and £2,282 was brought forward. A final dividend of 3½ per cent. is proposed, making 6 per cent. for the twelve months, and leaving £2,783 to be carried forward.

Tramways and Light Railways Estates, Limited.—The report states that the total revenue for the year to December 31 amounted to £804. After deducting administration and general expenses, there remains a surplus of £619, which, with £558 brought forward, makes an available balance of £1,177. The directors propose that this balance be appropriated, viz.: —Reduction of goodwill, £100; dividend on the shares at the rate of 3 per cent. for the year, £451; carried forward, £626.

Tynemouth and District Electric Traction.—The report for 1916 states that the total revenue amounted to £15,236, an increase of £240. The expenditure chargeable to revenue, including a provision of £1,000 for renewals, was £11,199, an increase of £676. The surplus is £4,036, making, with £597 brought forward, £4,634. The directors propose to place £1,000 to reserve, and to pay a dividend on the ordinary shares of 4 per cent. for the year, leaving £253 to be carried forward.

Wemyss and District Tramway Company.—The directors recommend a dividend of 7½ per cent. When the scheme was launched twelve years ago by the late Captain Wemyss, of Wemyss, many predicted that the venture would be a failure. The undertaking, however, has proved a success, and the receipts show an increase as compared with last year. Mr. Stephen Sellon was the engineer responsible for the scheme, and it was carried out in a thoroughly practical and economical way.

Improvement in Lancaster Tramway Finances.—Councillor T. Wilkinson, chairman of the Tramways Committee, has secured the approval of the Corporation to placing £1,500 from the past year's receipts to the reserve fund. He mentioned that the management of the tramways, added by greater appreciation by the public, had resulted in a saving of expenditure coupled with an increased income. The deficit would amount to £500. Eight years ago it was £3,200. The committee were building up the reserve fund.

Rate Relief at Newcastle.—To obviate an increase of three-halfpence in the city rate, Newcastle Tramways Committee offered the

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Corporation £7,000 from their funds. Councillor R. Mayne, chairman of the committee, stated that the profits for the year ending March 31 were estimated at £36,000, and the committee were placing £29,000 to the reserve fund, which would then amount to the requisite figure of £100,000. The offer was accepted by 36 votes to 8, several of the minority advocating that the money should be utilised in reducing fares.

Blackpool Tramways and Electricity Departments.—For the year ended March 31, the Corporation tramway receipts amounted to £94,368, which is more than £10,000 in excess of the previous record takings in 1913. The profits, amounting to £19,326, were, however, below the record established the same year by £5,226, but compared with the twelve months ended March, 1916, they showed an increase of £3,051. Easter receipts were £1,679, as against £3,380 in 1916. In the electricity department the income for the year was £45,791, and there was a loss of £887, this being the first deficit since 1902. The profit in 1915 was £8,500.

Halifax Corporation Tramways.—A profit of £14,559 is reported for the year ended March 31, a decrease of £4,496. The income was £114,684 (increase of £1,170), but the expenses were £100,125 (increase £5,667). The increased expenditure was largely due to repair of cars, interest charges and income-tax, and the cost of electric energy, which was 1¼d. per unit, compared with 1⅛d. per unit in the previous year. The receipts from passengers were £111,370, an increase of £1,240, and £1,974 was received from parcel traffic. Passengers numbered 21,180,584, an increase of 156,000, and the mileage run 2,048,772, a decrease of 147,208.

Record Aid for Preston Rates.—In presenting the budget statement at a meeting of Preston Corporation, Alderman Margerison, chairman of the Finance Committee, stated that the tramway traffic had increased by £6,500 to £57,600, and although expenses, war bonuses, income-tax, fuel, and materials had been much heavier, the gross surplus on the year's working would probably be £5,000. The balance brought forward would make that surplus £8,700, less £3,700 transferred to the borough fund for the current year, leaving £5,000 to open the new year. It was proposed to relieve next year's rate by £5,500, nearly a penny rate higher than any assistance hitherto given.

Johnson and Phillips, Limited.—Mr. R. W. Blackwell, chairman, presiding at the annual meeting, said that the board had considered it advisable in present conditions to carry £10,000 to general reserve, to place a further sum of £10,000 to special reserve account, and to reduce the book value of the company's patents by £2,575. The available balance after making all deductions was £18,711. During 1916 they added £14,015 to capital account by additions to buildings and plant, and provided £12,000 for depreciation. These increases demonstrated that the company were in a thoroughly sound position. They had not benefited by the war; they had merely held their own. They had met great difficulties with fair success.

Willans and Robinson, Limited.—This company, which is now controlled by Dick, Kerr and Company, Limited, again reports a satisfactory year's work. The accounts for 1916 show, after payment of debenture interest, provision for depreciation of plant and machinery, revaluation of stocks and allowances to employees on active service, a net profit of £20,090. The balance of dividend on the "A" preference stock is being paid, also the annual dividend on "B" preference stock and annual interest on those funding certificates outstanding. A dividend of 10 per cent. on the ordinary shares is recommended, leaving £12,140, of which it is proposed to add £10,463 to reserve and to distribute £1,677 among the holders of "B" stock and ordinary shares.

Yorkshire (Woollen District) Electric Tramways, Limited.—The report for 1916 states that the revenue amounted to £76,140, as compared with £71,594 for the year 1915, being an increase of £4,547. After deducting all expenses chargeable to revenue, and setting aside £5,100 to renewals fund, there remains a balance of £16,042, which, added to the amount of £2,947 from last account, makes an available balance of £18,989. The directors recommend a dividend at the rate of 5 per cent. per annum on the ordinary shares, carrying forward £3,487. At the annual meeting on April 18, Mr. E. Garcke (chairman of directors) moved the adoption of the report. He remarked that, taking everything into consideration, the company had done very well. In spite of omnibus competition an enormous number of passengers had been carried, and the shareholders were to be congratulated on the results. The report was adopted. Mr. E. Garcke was re-elected a director.

British Westinghouse Company.—Mr. J. Annan Bryce, M.P., chairman, presiding at the annual meeting on April 26, drew attention to the fact that the debentures redeemed during the year had had to be purchased in the market, and the price had not been below par. This bore witness to the excellence of the company's credit. It would have been possible to increase their dividend had it not been necessary to carry over a much larger sum than in 1915. The uncertain effect of the Munitions Act and excess profits taxation made this course necessary. During the year the orders had been more than maintained, and there had been a satisfactory addition to their trade with the Continent, while business with Australasia and South America had considerably improved. Referring to the excess profits tax, Mr. Bryce said he quarrelled not so much with the injustice but with killing the goose that laid the golden eggs. He could not believe that Mr. Bonar Law, himself a business man, would fail to recognise the disastrous effects of the excessive taxation of industry. So far other belligerent countries had shown more consideration for industry. Germany had not imposed an excess profits tax, and had not even increased the income-tax. As a result, the German electrical trade had accumulated vast sums in cash—it might prove to be only paper cash—for the inevitable fight after the war. The Allgemeine had accumulated a cash reserve of 7½ millions sterling, the Siemens-Schuckert 2½ millions, and the Bergmann 1½ millions, funds which were expressly mentioned as available for operations after the war. A great German firm maintained a factory in England entailing for the past ten years an annual loss of £100,000, with the express object of keeping prices in this country low, and so preventing that particular industry being able to compete abroad. If ever she should, Germany would renew the economic war more savagely and more unscrupulously than ever. When the vast mass of labour was set free and suffered from shortage of employment, there must be a catastrophe unless the Government, which had taken the manufacturer's money, stepped in behind him with its credit. An immense amount of work would have to be done after the war. The company had daily evidence of the business open to them in every country where they traded, but that business demanded great extensions to their works, and without large additions to their capital they would be unable to undertake it. In their report the directors stated that the improvement in the business of the company was maintained during the year. The net profit amounted to £199,646, and, including the balance brought forward of £44,332, there is a credit balance of £243,978, which it was proposed to appropriate as follows:—To writing off patents, goodwill, etc., £25,000; special depreciation of plant, £44,243; additional reserve for employers' liability, £10,000; dividend on 7½ per cent. preference shares, £75,000; leaving £89,734 to be carried forward.

LEICESTER CORPORATION TRAMWAYS.

The following is a summary of the report for the year ended December 31, 1916, with a comparison of the results of the three previous years:—

	1916.	1915.	1914.	1913.
Traffic revenue	£175,956	£159,678	£149,664	£147,458
Other revenue	40,315	28,842	20,571	17,059
Total	£216,271	£188,520	£170,235	£164,517
Working expenses ...	152,954	122,142	118,607	110,115
	£63,317	£66,378	£51,628	£54,402
Add Bank interest ...	157	355	—	416
Reserve fund interest ...	—	—	1,660	3,346
Gross balance ...	£63,474	£66,733	£53,288	£58,164
Interest on mortgages, etc.	£25,298	£26,229	£24,010	£23,541
Redemption of debt	16,574	16,647	13,765	12,453
Income-tax	7,401	4,484	2,801	2,122
Bank interest	—	—	207	—
War allowance reservists, etc.	12,044	7,412	1,284	—
Net balance	2,157	11,961	11,221	20,048
	£63,474	£66,733	£53,288	£58,164

From statistics given in the reports the following items have been extracted:—

	1916.	1915.	1914.	1913.
Units per car-mile ...	1·96	1·97	1 82	1·77
Power cost per car-mile	2·574d.	1·927d.	1·480d.	1·431d.
Traffic receipts per track mile	£4,630	£4,202	£4,045	£3,985
Traffic receipts per car-mile	10·279d.	9·827d.	8·682d.	8·758d.
Expenses per car-mile ...	8·935d.	7·516d.	6·880d.	6·560d.
Ratio of expenses to revenue	71%	65%	69%	66%
Total track mileage ...	38	38	38	38
Number of cars in stock	160	160	160	150

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LIVERPOOL TRAMWAYS RECORD YEAR.

EMPLOYEES' SUPERANNUATION FUND SHORTLY AVAILABLE.

Remarkable achievements of the Liverpool Corporation Tramways department are shown in the report of Mr. C. W. Mallins, the general manager, for the year ended December 31 last. The two chief features are that the undertaking greatly surpassed the record year of 1913 in receipts and passengers carried, and that this was accomplished amid the trying conditions imposed by training substitutes for a war-depleted staff and by the difficulty of obtaining material for the maintenance of the cars, the permanent way, and the overhead equipment. Of a total of 2,700 employees, 1,900 had joined the forces and 100 had given their lives in defence of their country. The vacancies had been filled by men incapable of military service and by women, and the work has been done as well as could be expected, having regard to the lack of experience and the ever-increasing traffic. The present staff consists of 1,311 men and 1,405 women employees.

Thirteen and a half million more passengers were carried than in 1913, the record year of the Liverpool system. The increase in traffic was due to the number of persons employed in munition and transport work. The number of free passes was as follows: —To military, naval, and wounded, 9,573,506, representing £44,237; and to nurses, 193,410, representing £803. No serious accident occurred, and even minor accidents have not materially increased. Mr. Mallins remarks that this is evidence of the care exercised by the staff, and shows that the fundamental principle of safety first, which is not of new birth in connection with the Liverpool tramways, is still carried out by the existing staff.

Early in the year the chairman, deputy chairman, and general manager preferred a request to the Ministry of Munitions for a priority certificate for the delivery of certain materials. This was granted, and together with the material already available there was sufficient to maintain the rolling stock and overhead equipment in an efficient condition, and to-day the whole of the cars, overhead equipment, and permanent way are in a perfectly safe and serviceable condition, with the exception of the lines leased from the Bootle Corporation, which are maintained by that Corporation under agreement. Over 4,000 cars have been dealt with for repairs at the Lambeth Road works. Owing to war conditions, the contractors for new motor equipments have only been able to deliver a limited number during the year.

The net profit for the year was £145,971, an increase of £22,777 as compared with 1915. The total capital expenditure now amounts to £2,068,435. The amount allocated to the sinking fund and redemption for debt stands at £1,430,360, while £844,788 has been placed to the reserve, depreciation, and renewal account. In addition £797,898 has been paid in relief of rates. These results have been obtained with very low fares. Passengers may travel 3 miles 207 yards for a penny, which compares with 1 mile 685 yards on seventy-two other municipal tramway undertakings in the kingdom. Many of these towns, however, give concessions to working men for a limited number of hours each day. The average earnings per car-mile for the past year amounted to 13·97d., an increase of ·77 over 1915. The particulars set out in the appended table show the results for 1916 compared with those of the three preceding years:—

	1916.	1915.	1914.	1913.
Capital expenditure	£2,068,453	£2,068,453	£2,062,391	£2,024,707
Loans outstanding	£1,008,694	—	£1,168,685	£1,177,384
Traffic revenue	£738,321	£696,893	684,026	£677,881
Total revenue	£766,577	£726,078	£722,307	£715,120
Working expenses	£518,037	£488,274	£473,678	£451,667
Gross balance...	£248,540	£237,804	£248,629	£263,453
Net profit	£145,971	£123,193	£134,821	£154,163
Passengers carried	157,836,595	150,755,680	145,656,374	144,085,927
Average fare per passenger ...	1·124d.	1·109d.	1·127d.	1·129d.
Car mileage	12,688,163	12,682,018	13,657,888	13,442,605
Traffic receipts per track-mile ...	£5,954	£5,620	£5,516	£5,695
Traffic receipts per car-mile ...	13·97d.	13·20d.	12·02d.	12·10d.
Power cost per car-mile	2·490d.	2·348d.	2·171d.	2·164d.
Operating costs per car-mile ...	9·798d.	9·240d.	8·323d.	7·977d.
Total charges per car-mile ...	11·738d.	11·409d.	10·322d.	10·015d.
Ratio of expenses to revenue ...	67·5%	67·2%	65·6%	63·2%

The reserve, renewal, and depreciation fund now amounts to £844,788. Electric traction was inaugurated in November, 1898, and since that time £797,898 has been contributed in relief of the rates. The retirement fund for employees who are members of the Tramways Benefit Society is now in the tenth year of its existence, and it has reached £30,000. The fund will shortly be available to meet the claims arising from old age and other infirmities.

Proposed Purchase of Mexborough Tramways.—Rotherham Electric Light and Tramways Committee on May 2 recommended the Corporation to give full authority to their sub-committee to enter into negotiations and to complete an agreement with the Mexborough and Swinton Tramways Company for the purchase of that undertaking and their Rawmarsh and Swinton electric light undertakings.

CONTRACTS AND ORDERS.

Leyton Council have ordered a supply of trolley wire from the British Insulated and Helsby Cables, Limited.

Stewarts and Lloyds, Limited, have an order from Brighouse Council for the supply of wrought-iron tubes and fittings.

Glasgow Council have placed a contract with the British Thomson-Houston Company, Limited, for a supply of three 1,000-KW. rotary converters.

B. F. Goodrich Company, Limited, have received a two years' contract for the supply of tires for the battery vehicles of Sheffield Health Committee.

Tudor Accumulator Company, Limited, are supplying, erecting, and setting to work a battery of accumulators, with booster, etc., at Aberdare Council electricity works.

Barrow Council have placed contracts as follows:—Stirling Boiler Company, water tube boiler; British Thomson-Houston Company, Limited, 250-KW. rotary converter.

Marylebone Electricity Committee have recommended the acceptance of the tender of the Underfeed Stoker Company for two additional mechanical stokers at £1,809.

Glasgow Tramways Committee have accepted the following tenders:—Special track work, E. Allen and Company, Limited, and Hadfields, Limited; cable, Pirelli-General Cable Works, Limited.

British Thomson-Houston Company have an order for the supply of switchgear to Bedford Council in connection with the electricity works extension and for switchboard equipment to Derby Corporation.

Bedford Corporation have accepted the tender of the British Thomson-Houston Company for switchgear at £1,650; of J. P. Hall and Sons for feed pumps at £340; and of T. and T. Vickars for coal handling plant at £718.

Salford Tramways Committee have accepted the following tenders:—Briggs, Jones and Gibson, Limited, Manchester, women inspectors', conductors', and trolley girls' uniforms, £1,072 7s.; C. Macintosh and Company, Limited, Manchester, macintosh coats and cap covers, £788 19s.

Walthamstow Council have accepted the tender of Custodis, Limited, at £1,143, for the erection of a chimney shaft at the electricity works. An order for trolley heads is to be placed with Messrs. W. Wood and Company, and for trolley wheels with the Anti-Attrition Metal Company.

Shepherd's Parging Block Company, Limited, makers of the block parging for supporting the paving alongside tramway rails, although experiencing difficulties in connection with manufacture and delivery, are maintaining a fair output. Orders at present in the course of execution include those from Rhondda Tramways, Wigan Corporation Tramways, and Haslingden Corporation Tramways. The firm have issued a folder illustrating the use of their block parging, and they will be pleased to send a copy to anyone interested in permanent way work.

Sydney Electricity Committee have recommended that the city electrical engineer be authorised to negotiate with the British Westinghouse Company for the supply of two 12,000-KW. turbo-alternators. The committee have also advised the acceptance of the company's tender for the supply and erection of switchgear at £7,790, inclusive of £705 to cover freight insurance, provided the company satisfy the engineer that they have previously executed similar installations. If the engineer is not satisfied on that point the contract is to be offered to the Australian General Electric Company at £8,741, subject to a similar condition.

Manchester Electricity Committee have placed the following contracts:—Davenport Engineering Company, Limited, cooling tower; W. J. Jenkins and Company, Limited, coal conveying plant; Mather and Platt, Limited, motors for cooling towers; J. Gerrard and Sons, Limited, and C. H. Normanton and Son, Limited, foundations, etc., for turbo-generators; Jowett Motor Manufacturing Company, Limited, electric tipping wagon; British Thomson-Houston Company, Limited, synchronous condenser; Pirelli-General Cable Works, Limited, British Insulated and Helsby Cables, Limited, C. Macintosh and Company, Limited, and W. T. Glover and Company, Limited, cable; British Thomson-Houston Company, Limited, extra high-tension switchgear and reactances.

Contracts for Electrical Stores have been placed by Bolton Corporation as appended:—Single-phase transformers, British Electric Transformer Company, and Johnson and Phillips; three-phase transformers, Brush Electrical Engineering Company; troughs, bends, cable supports, etc., Doulton and Sons; cable necks and cleats, Siemens Brothers and Company; cable, etc., W. T. Henley's Telegraph Works, and British Insulated and Helsby Cables, Limited; fuse boxes, Reason Manufacturing Company; wire, C. Macintosh and Company, and Liverpool Cable Company; lamps, General Electric Company, Limited; meters, Ferranti, Limited; meter time switches, Venner Time Switch Company, Limited; motors, McClure and Whitfield; steel conduits and fittings, Credenda Conduits Company.

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PERSONAL.

Mr. A. W. Clegg has been appointed electrical engineer to Accrington Corporation.

Mr. H. Pilling, general manager and engineer of Accrington Corporation Tramways, has been granted an increase in salary of £50 per annum.

Mr. P. W. Beatty, chief engineer of the Anglo-Argentine Tramways Company, has left Buenos Ayres with the intention of offering his services to the War Office.

The Right Hon. Sir Albert Stanley, M.P., President of the Board of Trade, and Lady Stanley were among the guests of His Majesty the King at Windsor Castle from April 21 to 23.

Mr. W. Clough, general manager, Bury Corporation Tramways, has an appointment in the Admiralty Shipyard Labour department. The Council agreed to lend his services to the Government on certain conditions.

Mr. C. C. Atchison has been presented with a silver cigarette case by the members of the Lancashire and Cheshire Municipal Electrical Engineers in recognition of his services for fifteen years as borough electrical engineer of Rochdale. Mr. J. A. Robertson (Salford), in handing the gift to Mr. Atchison, expressed regret that ill-health had necessitated him resigning his appointment.

Captain A. R. Owen, tramways and marine claims superintendent of the tramways department of the London County Council, having reached the age limit, retired from the Council's service on April 2, and has been granted a retiring allowance. Captain Owen entered the service in November, 1904, as manager of the Thames steamboats, and was appointed tramways and marine claims superintendent in July, 1910.

Mr. W. G. T. Goodman, general manager and engineer of the Adelaide Municipal Tramways Trust, who intends to visit Great Britain, Canada, and the United States, has been appointed an honorary commissioner by the Deputy Governor (Hon. G. J. R. Murray) to inquire into and report upon the following questions: — Electrification of railways, mechanical handling of coal, electric power in its relation to the development of industries, equipment and management of engineering workshops, and the briquetting of lignite coal.

Salaries Increased at Bradford.—The Corporation have granted the following increases of salaries:—Tramways department—Mr. T. Stirk, traffic superintendent, by £50, to £300; Mr. T. B. Moseley, chief clerk, by £25, to £225; Mr. S. Pearson, works superintendent, by £40, to £200; Mr. J. W. Falkingham, correspondence clerk, by £40, to £200; Mr. E. Webster, engineering assistant, by £22, to £130 16s. Electricity department—Mr. T. Roles, city electrical engineer, by £100 a year, to £900; Mr. J. H. Shaw, deputy electrical engineer, by £100, to £450; Mr. J. Fairbairn, works superintendent, by £50, to £350.

Mr. W. B. Worthington, of Derby, has been elected by ballot as president of the Institution of Civil Engineers for 1917-18. The vice-presidents elected are:—Mr. J. A. F. Aspinall (Liverpool), Mr. H. E. Jones (London), Sir J. P. Griffith (Dublin), and Mr. J. A. Brodie (Liverpool). The Council have made the following awards for papers read and discussed during the session 1916-1917:—Telford gold medals to Messrs. G. W. Humphreys and J. B. Ball (London); "George Stephenson" gold medals to Messrs. P. V. O'Brien and John Parr (Perth, W.A.); Telford premiums, Messrs. P. V. O'Brien (Perth, W.A.), J. L. Hodgson (Luton), W. Brown (Glasgow), and P. M. Crosthwaite (London); and a Crampton prize, Mr. F. J. Waring, C.I.E. (London).

Mr. T. J. Kendrew's recent increase of £50 in his salary as general manager of Southport Corporation Tramways, was productive of a discussion that testified to the success of his work. Alderman Griffiths, chairman of the committee, testified to the economies that the manager had effected, and said he would have liked to have increased the advance. Councillor Wood remarked that in 1913 there was a deficit of £2,442, whereas in 1916 there was a profit of £909. On energy alone, reckoning the same mileage in 1916 as in 1915, the saving would have been £300, and taking into account the increased mileage it was £680. The manager had the confidence of the employees, and during the past three years the Tramways Committee's minutes had not been challenged.

Mr. Wm. Firth, who died on April 12, at Leeds, was for many years chairman of the Highways Committee of Leeds Corporation. That committee had charge of tramway matters while the undertaking belonged to a company, and he was the leading figure in the purchase of the tramways by the Corporation in 1894 for the sum of £115,000.

Mr. F. Gilbert, manager of the Clerkenwell Road depot of the Dunlop Rubber Company, and general supervisor of the company's London depots, has died after a short illness from pneumonia. Mr. Gilbert was known in the motor omnibus world as the secretary of the Vanguard Company, prior to the amalgamation with the London General Company.

TRAMWAY AND LIGHT RAILWAY NOTES.

DUDLEY.

IMPROVEMENTS PROMISED—SHELTERS FOR PASSENGERS.

A committee of the Corporation have reported that they have waited upon the general manager of the tramways within the borough with reference to tramway improvements. The committee expressed the belief that improvements would be made when practicable. In commenting upon this statement the *Dudley Herald* says:—"In itself the Dudley system is really excellent because it is so comprehensive. From seven points cars convey passengers, but when it comes to termini arrangement there is much that is wanting. There is no general termini. One route ends in Wolverhampton Street, two more in the Market Place, and the remainder at the railway station." Dudley has been served in turn by horse, steam, and electric tramways, and for several years the company have also been running motor omnibuses. The Corporation have decided to provide and maintain shelters at the tramway termini, and to ask the company what contribution they can make to the cost. The plans of the structures are now being prepared.

DUNDEE.

THE TRAMWAYS AND GOODS TRANSPORT—WOMEN CONDUCTORS AT LAST—ENCOURAGING CONDUCTORS TO BECOME MOTORMEN.

A committee of the Harbour Trustees who have considered the subject of tramway haulage for jute at the harbour have recommended that no action be taken in the matter. Ex-Provost Soutar, in an interview on the question, has contended that tramway haulage would slow down the discharge of jute, as a great deal of extra handling would have to be done, especially as the tramway could not be taken inside the warehouses. Motor lorries and carts, however, could be run into a warehouse to the desired spot. Owing to the shortage of men and youths nearly one hundred women have lately been taken on as conductors. The Tramways Committee have increased the wages of motormen by 3s. a week, making the starting wage 35s. and the maximum 42s. As there are a number of men conductors in the service, and the military authorities are pressing the manager to release drivers fit for general service, the committee hope that by granting extra wages to drivers a number of the conductors will qualify as motormen.

HUDDERSFIELD.

PREFERENTIAL ENTRY FOR ALL-THE-WAY PASSENGERS—THE QUEUE SYSTEM—SERVICES IN FOGGY WEATHER.

On the Marsden section the manager of the Corporation tramways has been given permission to experiment in the running of special cars on which long-distance passengers will be given preferential entry at the termini on paying the fare before entering the cars. Owing to the successful working of queues for tramway passengers established elsewhere, Huddersfield Council have approved of plans by the borough engineer for the erection of queues in John William and Northumberland Streets. The coroner, in summing up at an inquest on the body of a man who was knocked down by a car on a foggy night, expressed the hope that the instructions of the Corporation as to running in dark and foggy weather were observed. It was a question, he said, whether on nights like this the cars should not return to the depots. It may be mentioned that although when the rush hours have passed motormen in various towns are not adverse to housing their cars if a fog is prolonged, the coroner's remarks serve to emphasise the great degree of safety attached to tramway traffic in a fog.

KEIGHLEY.

THE RAILLESS TROLLEY ROUTES.

A suggestion was made at the last meeting of Keighley Council that the charges on the railless traction routes should be raised, in order to make up for a decrease of £36 during the preceding month, Councillor Albert Smith, chairman of the Tramways Committee, replied that the committee had no power to increase the fares. These were fixed for them, and if they were not at the maximum now they were not very far off. Owing to the state of the roads and the darkness they had not been able to run as extensive a winter service out of the town as the committee would have liked, but now the longer days had come they hoped to give a better service.

LONDON.

DETECTION OF FARE EVASION—HALFPENNY STAGES—SERVICE REDUCED AND RESTORED—DRIVING AS A HOLIDAY TASK.

Travelling inspectors are being employed on the London County Council tramways to detect persons who evade payment of the fare, a practice which the Council's solicitor on April 16 informed the Lambeth stipendiary is largely on the increase. One defendant who rode without paying was followed and stopped by an inspector. A fine of 20s. and 20s. costs was imposed. The halfpenny stages are being revised in order to prevent overlapping and overriding. On the several south London routes which have been dealt with, the Highways Committee have not ventured to curtail the excessively long distance to the Elephant and Castle. The alterations in stages will undoubtedly facilitate fare collection. Owing to

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the cars being required on routes used by munition workers, the London United Tramways recently withdrew the Kingston Hill and Ham boundary services. Local interests petitioned Kingston Corporation and the Board of Trade, with the result that on April 23 a conference was held between representatives of the Council and the company. Subsequently the latter announced that the Kingston Hill service would be immediately resumed, but they desired to abandon the other section for the period of the war. A committee of the Council decided to further consider the latter proposal. A Croydon councillor, who was instructed as a motorman during the strike on the Croydon Corporation Tramways last year, spent the Easter holiday in driving a car. As the department is handicapped by a shortage of motormen, the general manager much appreciated the assistance.

MANCHESTER.

THE TRAFFIC CONGESTION PROBLEM.—ARTERIAL CENTRES FOR TRAMWAYS.

Under the presidency of Ald. R. Wilson, the Traffic Congestion Committee of the Corporation on April 18 again gave consideration to the scheme for the construction of new streets to relieve the congestion in and near Piccadilly, London Road, Oldham Street, and Oxford Street, and to utilise the old infirmary site as a tramway terminal and offices. To the latter proposal there is considerable opposition, on the ground that the site should be retained for the erection of an art gallery and free library. The estimated cost of the scheme is £1,000,000, and besides providing new thoroughfares it would give the advantage of arterial centres for the marshalling of tramway traffic. It is suggested that a compromise might be effected on the infirmary site question by purchasing a block of property adjoining George Street and Mosley Street, thus increasing the area of the site. In addition to the members of the committee at the meeting it was attended by Mr. J. M. McElroy, general manager of the tramways, Mr. R. Peacock, chief constable, and Mr. J. B. Meek, city engineer. After a three hours' sitting the further consideration of the report was adjourned.

MORECAMBE.

NEED OF UP-TO-DATE TRACTION.

Alderman Snowden, in submitting Morecambe Corporation budget, stated that since the horse tramways had come under municipal control £7,200 had been contributed to the relief of the rates. No one would say that horse traction was satisfactory, and the sooner the Council decided upon a system more in keeping with the progressive spirit of the town the better.

MEXBOROUGH.

SUSPENSION OF SERVICES.

The Mexborough miners are amongst the passengers affected by the Mexborough and Swinton Tramways Company having been obliged to suspend their railless trolley car services to the Conisborough district. The company also anticipate that they will have to withdraw the railless service to Manvers Main. These steps are due to the taking of drivers for military service and the impossibility so far of finding substitutes.

PLYMOUTH.

TRAFFIC STILL RISING WITH THROUGH RUNNING TO DEVONPORT.

The wisdom of the Corporation taking over the undertaking of Devonport Tramways Company, on the advice of Mr. J. B. Hamilton, general manager at Leeds, has been amply demonstrated during the war. The dockyard at Devonport, which, with Plymouth, now forms one borough, had long called for through running, and the boon was speedily given. There has been a pronounced increase in traffic, not only to Devonport but on the combined undertakings generally, and at the Corporation's meeting on April 16 Ald S. H. Phillips, chairman of the Tramways Committee, stated that the returns for the past month showed a substantial increase. They were carrying passengers to the utmost capacity of the tramways rolling stock and the permanent way. The management and the committee would like to make many improvements, but while the war was in progress it was impossible to obtain further cars or to extend the present facilities.

SALFORD.

CROSS-TOWN ROUTES.

Criticism of tramway services comes with bad grace from any local public in these days of difficulty, and it is surprising to find a correspondent of a Salford newspaper attributing the cause of delays to the cross-town traffic. Mr. G. W. Holford, general manager, when asked for his opinion on the subject, informed a *Manchester Dispatch* interviewer that in every large tramway town the endeavour is to create cross-town routes, inasmuch as these provide connected services for the inner portion of the town. Salford was not alone in this respect; in Manchester cross-town services were provided wherever possible. Salford was not favourably situated for terminating routes in the centre of the city, but it is understood to be the intention of the department to institute, as far as possible, short service routes terminating on one of the town bridges. Mr. Holford asked that the public should remember the handicap under which traffic is now carried on, and added that the committee and himself were always ready to consider suggestions.

ROCHDALE.

CONVENIENCE OF INTER-URBAN TRAMWAYS.

Where inter-urban tramways exist they are proving a convenience to people who have been obliged to abandon railway travelling on account of the 50 per cent. increase in fares. The districts between Rochdale, Huddersfield, and Halifax are an example. Except for the interval between Summit (Littleborough) and Hebden Bridge a tramway ride may be taken from Rochdale to Huddersfield. The intervening distance is traversed by motor omnibuses from Steanor Bottom, 300 yards beyond the Summit terminus, to Eastwood, 1½ miles from the Hebden Bridge terminus at Halifax. The fare from Hebden Bridge to Halifax is sixpence, from Halifax to West Vale twopence, and from West Vale to Huddersfield central terminus fourpence.

WORCESTER.

PROTECTION FOR MOTORMEN.

After considering the reply of the Worcester Electric Traction Company to a suggestion that protection from severe weather should be provided for motormen on the cars, the City Council have asked the company to provide such protection by next winter.

WEST HARTLEPOOL.

TO PREVENT STANDING ON PLATFORMS.

In order to obviate the likelihood of serious accidents through passengers standing on the car platforms, the acting manager of the West Hartlepool tramways has ordered the cars to be stopped in the event of offenders refusing to leave. Councillor Charlton, deputy chairman of the Tramways Committee, in securing the sanction of the Corporation to the decision, said such action was necessary for the safety of the public, and Councillor Turnbull remarked that many fares went uncollected owing to the conductors being unable to do their work properly on the overcrowded cars.

WALSALL.

ADOPTION OF TROLLEY REVERSERS.

Experiments with a trolley reverser have been conducted at Walsall by Mr. R. L. Horsfield, general manager of the Corporation tramways, with the result that the committee have decided to have the apparatus fixed at the termini.

TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION.

ANNUAL MEETING AND CONGRESS.

The annual meeting and congress of the Tramways and Light Railways Association will be held on Friday, June 29, at the Institution of Civil Engineers, Great George Street, S.W. The annual meeting will be held at 2.30 p.m., and at 3 o'clock a paper will be read by Mr. Arthur Norton, of Brown, Bayley's Steel Works, Limited, on "The Manufacture, Life, and Maintenance of Steel Tires." The paper will be illustrated with lantern slides. We understand that the lecture will be open to all those interested in tramways.

After the reading of the paper, members will have an opportunity of introducing subjects on which discussions will be invited. Those who wish to suggest a topic should communicate with the Secretary, Mr. A. de Turckheim, Sanctuary House, Tothill Street, Westminster, S.W. Arrangements will be made so that members who wish to do so may dine together in the evening. Further particulars will be published later.

PATENT LIST.

Abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

*** If the inventions have been communicated the names of the communicators are given below in italics.

APPLICATIONS FOR LETTERS PATENT.

Means for lubricating engine of motor road vehicles (4,859)—Hillman Motor Car Company and A. J. Dawson.

Apparatus for warming tramway and railway vehicles (4,794)—J. H. Robinson.

Change-speed gear for motor vehicles (4,741)—F. Sabel.

Regulation of fuel supply to internal combustion motor-driven vehicles (5,049)—N. Andrews.

Light railways (5,248)—F. H. Dutton.

Motor vehicles (5,300)—S. O. Edmonds.

Wheels for motor-propelled freight-carrying vehicles (5,225)—International Motor Truck Wheel Corporation and F. A. Frommann.

Points or switches for tramways (5,261)—Sir R. A. Hadfield.

Life guards for motor vehicles (5,208)—F. A. Poupard.

Lifting jacks for vehicles (5,057)—F. L. Rapson.

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Machines for dressing rails (4,976)—G. Tanner (*W. E. Hanshue*).
Railroad ties (5,271)—P. V. Troupe.
Controlling current in connection with electro-magnetic gear boxes of automobiles (5,009)—Wolseley Motors, Limited, and T. Wardell.
Signalling on trains (5,008)—H. F. C. Whitehead.
Rail joints (5,138)—J. Zahuranec.
Vehicles of the self-laying track type (5,625)—H. E. Clark and L. C. Jackson.
Tramways (5,586)—W. A. Dark.
Motor vehicles (5,470)—F. B. Dehn (*Parrett Tractor Company*).
Means for converting pleasure vehicle chassis into commercial truck chassis (5,468)—W. F. Hudson.
Side bearings for railway vehicles (5,462)—L. Janse.
Continuous brake apparatus for trains (5,565)—H. F. Ward.

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ATTWATER & SONS
Hopwood Street Mills, PRESTON
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Fare tickets and fare ticket devices for tramways and omnibuses (5,965)—W. Aitken.
Fixing and unfixing metal sleepers to and from flanged light railway rails (5,908)—W. H. Ashmore.
Section insulator for overhead electrical equipment (6,019)—H. Burton and J. Whelan.
Motor vehicles (5,639)—W. E. Clarke, C. H. Crawley, and M. E. Starkey.
Automatic direction and stopping indicator for vehicles (5,736)—B. W. Coopey.
Control signal for vehicles (5,672)—J. W. Patience.
Self-laying tracks for vehicles (5,652)—E. P. Pink.
Motor road vehicles (5,696)—W. J. Rusdell.
Life guards for tramcars (6,014)—A. Smith.

Specifications Published.

1915.

Axles for motor cars (17,697)—Abramson.

1916.

In the following list the numbers in italics are those that the specifications will finally bear and under which they will be indexed and abridged before acceptance and finally printed. The application numbers should, however, still be used for correspondence purposes.

Starting mechanism for automobiles (4,019—*104,557*)—W. J. Mellersh-Jackson (*A. Churchward*).
Clutch mechanism for use on motor vehicles (4,314—*104,565*)—Humber, Limited, J. A. Cole, and F. T. Burgess.
Water-cooled internal combustion engines (8,253—*104,598*)—E. Sharman and S. H. Hile.
Reinforced concrete railway sleeper (14,610—*104,645*)—F. L. Rings.
Railway motor cars (15,549—*104,649*)—W. H. Buckingham and H. S. Johnson.
Motor vehicle bodies (16,936—*104,654*)—G. Maddox.
Tensioning devices for the couplings of railway vehicles (4,641—*104,763*)—T. F. Craddock (*A. Craven and Burn and Company*).
Electrical signalling systems (5,464—*104,777*)—T. McLeod.
Means for converting pleasure motor vehicles into commercial vehicles (7,739—*101,335*)—W. F. Hudson.
Traction wheel (10,123—*104,816*)—W. E. Hosch.
Means of control for petrol electric vehicles (10,361—*104,819*)—Tilling-Stevens, Limited, and P. F. Smith.
Route indicating and signalling devices for use on railways (4,104—*104,902*)—R. G. Berry and H. W. Moore.
Signalling apparatus for indicating the turning of motor vehicles (4,177—*104,908*)—H. O. Faulkner.
Steering gear for motor vehicles (4,358—*104,923*)—F. H. Solomon.
Mudguards for use on motor vehicles (4,754—*104,940*)—Humber, Limited, and J. A. Cole.
Automatic train-stop device (18,007—*102,740*)—T. T. Chaloner.
Life-saving guards for motor vehicles (4,570—*105,099*)—E. Presland.

1917.

Petrol engine bearings (1,263—*105,216*)—G. E. Bradshaw.

Colonial and Foreign Tramways Traffic Returns.

NAME OF COMPANY.	1916. WEEKS ENDED.					1917. WEEKS ENDED.					AGGREGATE.		
	April 1.	April 8.	April 15.	April 22.	April 29.	Mar. 31.	April 7.	April 14.	April 21.	April 28.	Wks.	1917.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Anglo-Argentine	50,588	52,399	53,462	47,697	52,781	52,762	47,910	56,123	53,625	49,844	17	868,055	+ 1,806
Auckland		20,767	(28 days)	...	...	...	21,178	(28 days)	...	...	40	214,586	+ 3,882
Calcutta ... ... Rs.	63,459	67,312	69,580	66,111	61,724	64,145	66,778	64,492	65,895	64,584	17	1,158,443	+ 15,911
Madras ... ... Rs.	30,818	(2 weeks)	32,361	(2 weeks)	...	38,708	(2 weeks)	33,945	(2 weeks)	...	17	276,092	+ 24,622
Pernambuco	2,817	3,165	2,876	2,963	2,741	3,513	3,751	3,660	3,472	3,792	17	60,836	+ 9,289

Companies Issuing Monthly Statements.

	1915.		1916.				1916.		1917.				Wks.	AGGREGATE.	
	Nov.	Dec.	Jan.	Feb.	March.	April.	Nov.	Dec.	Jan.	Feb.	March.	April.		1916-17.	+ or −.
	£	£	£	£	£	£	£	£	£	£	£	£		£	£
Ballarat & Bendigo ...	3,396	4,437	3,399	3,512	...	...	3,089	3,980	3,521	3,196	...	...	48	39,325	− 515
Brazilian Traction Mlrs	6336000	7082000	6626000	6276000	6913000	...	6943000	6527000	7266000	6872000	7549000	...	13	21,687,000	+ 1,872,000
Brisbane	31,120	...	32,280	30,320	34,275	...	26,740	...	33,020	29,800	33,340	...	13	96,160	− 715
British Columbia $	562,782	603,667	591,949	572,935	446,401	...	604,576	631,644	627,130	581,555	456,626	...	39	4,067,005	+ 240,185
Buenos Ayres Lacroze	46,033	43,528	40,595	39,137	42,219	...	42,603	40,106	38,142	35,977	41,337	...	39	346,351	− 26,531
Burma	23,695	22,185	21,906	20,345	22,958	...	26,824	30,250	23,803	22,912	27,132	...	35	208,850	+ 24,908
Cape Town	...	...	16,030	...	14,994	...	...	...	18,440	16,229	17,688	...	13	52,357	—
Carthagena & Herrerias	2,090	2,129	2,841	1,585	2,991	2,513	2,252	2,399	3,982	3,223	2,955	4,366	17	14,526	+ 4,596
Cordoba	13,798	13,026	12,335	11,831	...	...	12,836	12,327	12,437	11,898	...	...	48	147,585	− 755
East India	2,065	2,062	2,015	1,863	2,196	53,006	1,942	2,120	1,836	1,570	1,647	25,466	39	348,549	− 115,996
Kalgoorlie	2,611	3,018	2,236	...	...	...	2,555	2,894	2,431	...	...	...	4	2,431	+ 195
La Plata	4,564	4,563	4,533	4,345	4,611	4,354	4,342	4,436	4,315	4,092	4,527	4,229	17	17,164	− 681
Lima	30,720	35,110	...	...	34,169	...	33,625	35,845	...	...	37,569	...	13	108,681	+ 7,478
Manaos ... Rs.	...	...	...	...	...	...	142,858	158,110	146,493	144,532	...	...	—	—	—
Manila ... ... $	...	...	...	66,303	...	...	...	...	...	73,200	...	...	—	—	—
Mexico ... $	...	...	...	...	...	...	...	...	...	...	...	...	—	—	—
Monte Video	28,407	31,305	34,252	32,502	31,956	28,997	28,404	31,364	33,341	32,304	31,979	29,230	26	186,622	− 797
Peruvian ... $	751,720	823,600	862,100	775,700	...	...	925,820	990,842	935,130	844,770	...	...	34	7,285,392	+ 966,215
Port Elizabeth ...	...	...	4,193	3,857	...	...	...	...	4,498	3,553	4,428	...	13	12,479	—
Rangoon	5,028	4,492	4,763	4,674	5,501	5,036	5,033	4,904	4,633	4,605	6,226	4,849	—	—	—
Toronto ... $	851,113	...	906,350	846,256	910,969	...	911,829	...	1002469	932,567	...	991,192	13	2,926,228	+ 262,653
Winnipeg ... $	323,025	...	297,560	293,250	296,500	...	282,899	...	319,945	280,717	293,094	...	13	893,756	− 6,446

(*Continued on page 318*)

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TRAFFIC RETURNS—*continued.*

Tramways and Omnibus Undertakings in the United Kingdom.

NAME OF COMPANY OR CORPORATION.	1916. WEEKS ENDED.					1917. WEEKS ENDED.					AGGREGATE.		
	April 1.	April 8.	April 15.	April 22.	April 29.	Mar. 31.	April 7.	April 14.	April 21.	April 28.	Wks.	1917.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Aberdare U.D. Council	...	...	594	392	444	...	...	603	417	396	3	1,417	− 15
Aberdeen Corporation	1,612	1,757	1,667	1,688	1,734	1,794	1,757	1,845	1,782	1,847	47	88,406	+ 4,989
Accrington Corporation	...	429	539	533	...	...	247	810	530	...	3	1,587	+ 85
Ayr Corporation	246	274	279	313	442	262	295	321	310	300	50	18,933	+ 1,277
Bath Electric	*	...	...	...	...	...	...	...	...	...	—	—	—
Birkenhead Corporation	1,438	1,418	1,388	1,459	1,569	1,537	1,501	1,559	1,607	1,622	4½	6,399	+ 124
Birmingham Corporation	15,587	16,177	15,867	15,463	17,916	16,376	16,261	16,984	16,464	16,881	4	66,591	− 2,000
Birmingham Corp. Motor Omnibuses	736	842	807	768	1,176	855	837	917	860	915	4	3,530	− 224
Blackburn Corporation	1,016	...	...	...	...	1,128	...	...	...	...	—	—	—
Blackpool and Fleetwood	350	332	331	754	1,249	292	570	680	356	360	16	5,773	− 954
Blackpool Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
Bolton Corporation	2,763	3,726	2,619	3,442	3,107	2,706	3,695	2,895	2,937	2,987	4	12,737	− 215
Bournemouth Corporation	1,764	2,057	1,923	3,006	2,394	1,771	2,376	2,018	2,184	2,180	4½	9,664	− 1,312
Bradford Corporation	6,152	6,400	6,329	6,296	8,814	6,390	6,600	7,731	6,451	6,875	4	27,657	− 1,784
Brighton Corporation	938	974	910	1,241	1,431	963	1,140	1,146	1,112	1,196	4½	4,702	− 176
Bristol	4,269	4,761	4,695	4,548	5,917	4,696	4,893	5,387	4,901	5,299	16½	78,243	+ 960
Burnley Corporation	1,571	1,665	...	2,113	1,862	1,545	2,109	...	1,617	1,718	—	—	—
Burton-on-Trent Corporation	227	277	239	268	280	250	261	273	264	257	4	1,070	− 10
Bury Corporation	...	...	...	1,730	1,607	...	...	...	1,411	1,451	4½	6,292	− 211
Cardiff Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
Chatham and District	1,031	1,114	1,139	1,132	1,523	1,081	1,138	1,230	1,217	1,215	17	18,435	+ 209
Chesterfield Corporation	281	243	258	272	365	244	106	298	242	249	4	896	− 244
Colne Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
Cork Electric	433	468	465	471	508	465	462	465	492	568	17	7,656	+ 13
Croydon Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
Derby Corporation	1,043	1,071	1,277	1,139	...	991	1,072	1,078	1,018	...	3	3,168	− 319
Dover Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
Dublin and Lucan	113	129	130	134	170	121	141	156	128	155	17	2,083	+ 64
Dublin United	5,856	6,083	5,989	5,837	2,265	5,891	5,902	5,834	6,316	6,549	17	99,740	+ 4,221
Dundee City	1,240	1,354	1,325	1,263	1,354	1,319	1,339	1,391	1,323	1,356	49½	67,799	+ 1,062
East Ham Corporation	...	...	...	1,279	...	...	...	...	1,278	...	3	3,766	+ 43
Exeter Corporation	319	353	342	339	465	303	258	364	331	358	4	1,312	− 186
Gearless Motor 'Buses	*	...	...	...	...	...	...	...	...	...	—	—	—
Glasgow Corporation	21,610	22,303	22,533	22,422	23,082	24,362	24,133	24,424	25,286	25,661	47½	1,122,925	+ 87,911
Glossop (Urban Elec. Supply Co.)	...	...	125	151	154	...	...	134	127	140	17	2,161	− 45
Halifax Corporation	1,823	...	2,023	1,914	3,159	1,915	...	2,673	1,918	2,070	35	7,175	− 1,312
Halifax Corp. Motor Omnibuses	35	...	36	36	64	48	—	60	49	43	3½	166	− 1
Hastings and District	705	836	783	911	1,552	889	1,069	1,066	974	1,054	17	15,588	+ 2,217
Huddersfield Corporation	2,645	2,779	2,664	2,708	4,216	2,686	2,582	3,443	2,722	2,895	4	11,642	− 725
Hull Corporation	2,949	2,948	3,058	3,169	3,044	3,147	3,173	3,270	3,214	3,121	4	12,778	+ 45
Ilford U.D. Council	618	650	644	660	831	609	645	685	655	671	4	2,655	− 115
Ilkeston Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
Ipswich Corporation	482	457	423	496	577	359	400	455	425	451	4	1,755	− 205
Isle of Thanet	244	256	245	309	502	223	256	277	253	290	30	7,487	− 351
Kilmarnock Corporation	156	157	165	171	182	170	169	181	170	169	49½	8,634	+ 320
Lanarkshire	1,892	2,262	2,107	2,214	2,517	2,471	2,347	2,690	2,597	2,845	17	40,705	+ 4,381
Lancashire United	1,535	1,748	1,648	1,608	2,563	1,880	1,742	2,989	1,844	2,018	17	30,612	+ 2,961
Leeds City	8,796	9,335	8,992	9,017	11,833	9,517	9,081	10,850	9,814	10,120	4	39,868	+ 538
Leicester Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
Leith Corporation	764	893	798	786	827	869	871	900	884	938	49½	43,498	+ 5,180
Leyton U.D. Council	1,433	1,554	1,536	1,505	2,008	1,603	1,589	1,798	1,638	1,701	4	6,726	+ 123
Liverpool Corporation	13,021	13,665	13,443	13,567	14,877	14,293	13,888	14,345	14,732	14,971	16½	238,369	+ 13,713
Llandudno and Colwyn Bay	196	218	236	298	579	191	190	311	241	265	21½	4,167	− 416
London County Council	46,993	25,287	49,112	49,020	...	44,070	25,674	46,142	45,570	...	2½	123,419	+ 6,033
London General Omnibus	*	...	...	...	...	...	...	...	...	...	—	—	—
London United	*	...	...	...	...	...	...	...	...	...	—	—	—
Lowestoft Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
Maidstone Corporation	166	...	...	185	257	173	...	...	180	196	4	871	− 78
Manchester Corporation	17,469	18,237	17,663	18,088	20,066	18,346	18,622	18,903	18,713	19,503	4	75,741	+ 1,629
Metropolitan Electric Tramways	*	...	...	...	...	...	...	...	...	...	—	—	—
National Steam Car	*	...	...	...	...	...	...	...	...	...	—	—	—
Nelson Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
Newcastle-on-Tyne Corporation	5,946	5,893	5,981	6,111	6,136	6,942	6,761	6,717	7,039	7,321	4	27,977	+ 4,752
Newport (Mon.) Corporation	836	860	877	...	—	957	940	983	...	—	2	1,924	− 17
New St. Helens and District	814	940	904	854	1,426	1,032	974	1,566	1,025	1,139	43	46,741	+ 3,938
Northampton Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
Nottingham Corporation	4,426	3,300	3,698	3,738	4,362	5,375	2,476	4,103	3,766	3,894	4	14,241	− 858
Oldham Corporation	2,416	2,298	2,214	2,760	2,894	2,177	2,840	2,602	2,491	2,583	5	12,984	− 331
Portsmouth Corporation	2,232	2,515	2,452	2,515	3,297	2,075	2,293	2,721	2,445	2,523	—	—	—
Preston Corporation	1,212	...	964	1,005	1,185	1,560	...	1,194	1,063	1,088	3½	3,858	− 44
Provincial	2,112	2,329	2,171	2,318	2,816	1,777	2,135	2,283	2,156	2,311	30	59,791	− 2,329
Reading Corporation	752	...	...	902	...	813	...	...	899	...	3½	3,193	+ 86
Rhondda Tramways	880	1,231	1,188	1,206	1,673	1,394	1,357	1,810	1,436	1,401	17	22,295	+ 2,347
Rochdale Corporation	1,601	1,757	1,637	2,210	2,024	1,627	2,262	1,944	1,713	1,796	4	7,717	− 390
Rotherham Corporation	1,313	1,299	1,314	1,697	1,352	1,532	1,805	1,738	1,632	1,686	4½	7,737	+ 1,332
Salford Corporation	5,345	5,192	5,012	5,664	5,680	5,081	6,325	5,678	5,960	6,075	4½	25,194	+ 1,829
Sheffield Corporation	9,936	9,802	9,733	10,004	11,439	10,725	10,977	11,468	11,103	11,355	5	55,629	+ 4,715
Southampton Corporation	1,443	1,505	1,439	1,391	1,770	1,545	1,610	1,788	1,665	1,721	3½	6,026	+ 355
Southend-on-Sea Corporation	599	640	648	897	1,214	603	631	897	679	710	4	2,613	− 366
South Metropolitan Tramways	*	...	...	...	...	...	...	...	...	...	—	—	—
South Shields Corporation	743	714	754	824	892	811	871	869	812	845	4	3,396	+ 193
Sunderland Corporation	1,030	1,617	1,507	1,578	1,593	1,490	1,678	1,618	1,592	1,610	4	6,499	− 237
Sunderland District	597	629	547	576	889	643	509	813	672	684	26	16,380	+ 1,411
Swindon Corporation	177	189	177	169	254	212	211	251	216	237	3½	807	+ 110
Torquay Tramways	408	491	489	479	824	463	468	631	548	606	17	7,977	+ 510
Tramways (M.E.T.) Omnibus Co.	*	...	...	...	...	...	...	...	...	...	—	—	—
Tyneside Tramways and Tramroads	507	560	532	515	675	666	600	780	642	725	17	10,417	+ 1,854
Wallasey Corporation	1,129	1,216	1,175	1,295	1,658	1,195	1,196	1,346	1,274	1,315	4½	5,131	− 437
Walsall Corporation	741	790	776	788	1,090	803	831	1,042	812	835	4	3,520	− 116
Walthamstow U.D. Council	881	1,000	959	987	1,398	960	976	1,116	1,031	1,113	4	4,236	− 75
Warrington Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
West Ham Corporation	2,920	3,126	3,097	3,148	3,691	3,192	3,231	3,418	3,250	3,388	3½	12,243	− 385
Wigan Corporation	1,514	...	...	...	...	1,710	...	...	...	...	52	87,447	+ 8,243
Wolverhampton Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
Yorkshire (West Riding)	1,755	1,629	1,557	1,764	2,410	1,766	1,938	2,301	1,866	1,976	17	31,350	+ 3,617

* TRAFFIC RETURNS SUSPENDED.

Owing to the European war, the Government have taken over the railways of Great Britain as from August 4, 1914, and the issue of traffic returns has been suspended. Consequently the traffic returns of the electric railways which usually appear on this page cannot be given.

The Publication of the Traffic Returns of the Tramways marked with an asterisk in the above table have also been suspended during the war.

TRAMWAY DIRECTORIES.

A useful feature of this issue is the directory of electric railways and electric tramways which will be found among the advertising pages. This directory contains the names of the chief officials and the principal particulars relating to each undertaking.

THE TRAMWAY AND RAILWAY WORLD

can be obtained, post free, at the following rates:

For the United Kingdom—
Twenty-five Shillings per annum (including 64 issues, of which 12 are large illustrated numbers).

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THIS expressive term has more than usual significance when applied to Daimler Commercial Vehicles. War service has proved that under the most trying conditions the Daimler is to be relied upon absolutely.

Here is a pre-war record from the Crosville Motor Co., Ltd., Chester:

20,000 miles

Repair Bill £2 : 13 : 4

"This vehicle, bought in 1913, has now done 125,000 miles, and is still one of the best in the fleet."

The secret of this success is the Daimler Sleeve-Valve Engine, the finest materials and Daimler craftsmanship.

The Daimler Company Ltd.
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MOTOR VEHICLES.

TWO MODELS

TO CARRY 30/45 CWT. & 3½ TONS RESPECTIVELY

"The Design and Construction are Throughout of a Character, which it would be Exceedingly Difficult, if not Impossible, to Improve Upon."

RAILWAY GAZETTE, MARCH 31, 1916.

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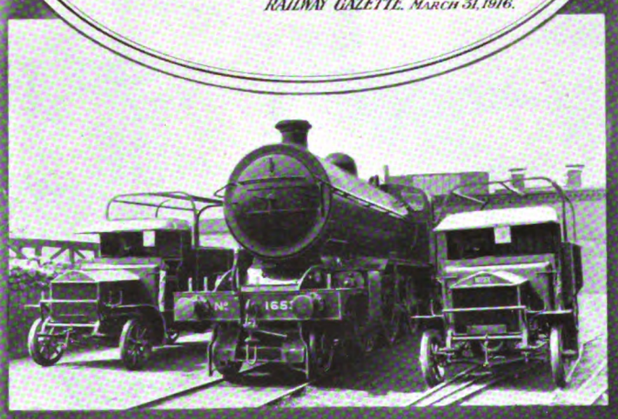
USED BY THE LARGEST CARRYING COMPANIES AND COMMERCIAL HOUSES.



IN WAR

USED BY THE BRITISH AND ALLIED GOVERNMENTS.

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As might have been expected, the circular letter issued by the Commissioner of Police for the Metropolis on the subject of the weight limits of motor omnibuses has aroused much interest, and, in some quarters, a certain amount of criticism. The present standards, as is well known, are 3½ tons unladen, or not exceeding 6 tons fully loaded in all respects. These limits were fixed eight years ago, and hitherto it has been generally believed that they afforded a very satisfactory compromise between conflicting interests. So far as possibility of change was involved, the common impression has been that improvements in design, more particularly in relation to suspension, coupled with road construction better suited to modern heavy traffic, might warrant an extension of these limits, with a view to greater carrying capacity and therefore more economical operation. The possibility of a reduction in the permitted weights has hardly suggested itself, for, apart from the desirability of increasing rather than decreasing the present standard of 34 passengers, the present limit has always been regarded as cutting things rather fine. The engine power it allows, for instance, is none too generous, and in passing the official tests—taken on the "unladen" basis—that word "unladen" has always been somewhat liberally interpreted. For the purposes of such tests the load to be deducted in order to arrive at the unladen condition has invariably been treated as including a good deal besides passengers. In fact, the omnibus, as submitted to the authorities on these occasions, is kept down to the requisite limit only by a drastic elimination of all that is not absolutely essential at that time. Thus the regulations are complied with, but only with some contriving and difficulty, and it is obvious—as it always has been—that the existing limit of 3½ tons gives no latitude worth mentioning, and the problem of how omnibuses conforming to a lower standard of maximum weight are to be successfully produced and operated is one whose solution will demand no little skill. Admittedly, the task thus set is not in any sense an impossible one. That, however, is not really the question; the actual issue is whether this new demand foreshadowed by the Metropolitan Police Commissioner is expedient in public interests and just in its treatment of motor omnibus enterprise. The opportuneness of such a communication at the present time might also be questioned, especially if the Commissioner, as is apparently the case, has not consulted the omnibus owners.

As already indicated, it is no use pretending that the reduction of the present standards, together with the retention of the same seating capacity, and with due regard to the necessity of reasonably substantial construction, will be easily achieved. It is quite true, as the Commissioner suggests, that there have been important developments in almost every direction of motor vehicle manufacture and design. So far, however, as any notable reduction in weight is concerned, these improvements mainly relate to other types than heavy commercial chassis. By a certain degree of substitution here and there some reductions in the weights of omnibuses can be effected, but it is to be doubted whether it will be practicable to do this with any appreciable satisfaction to what may be called the "anti-'bus" point of view, and at the same time to maintain the present capacity. The question, too, must be asked as to how far it is reasonable to saddle the motor omnibus with responsibility for the inconvenience or damage that is alleged to result from the prevalence of heavy traffic on unsuitable roads. In these complaints there are always the two factors of the vehicle and the road to be borne in mind. As to the former, the motor omnibus is in a relatively decreasing minority of the heavy vehicles that go to make up the traffic of the streets, and it follows therefore that regulations aimed at omnibuses alone can only partly eliminate the trouble that may arise from such heavy traffic. The omnibuses may be everything that can be officially desired, but that will not avail unless heavy goods lorries are subjected to a like set of regulations. It is palpably useless, so far as the incidental effects of traffic are involved, to keep down motor omnibuses to a limit of less than six tons if other traffic units of something like double that weight are still to be permitted. Thus, in making regulations affecting omnibuses solely, all that will be achieved will be that difficulties will be placed in the way of a necessary public service without any substantial corresponding benefit. At an earlier stage in the history of motor transport it might have been possible —whether advisable or not—to have fixed a lower maximum for heavy motor cars than that now obtaining, but the day for that kind of thing has now passed. We are therefore faced with the position that there must inevitably be heavy motor traffic, and that motor omnibuses are not, and never will be, the heaviest vehicles on the road. Thus is revealed the innate inexpediency of the additional restrictions that are

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MOTOR TRAFFIC.

now proposed. The real question, in fact, is one of roads, which must in these times be adapted to carry far heavier traffic than that of motor omnibuses. That need being recognised and met, even the existing London police limits might reasonably be extended, and therefore the suggestion of greater stringency seems to be doubly superfluous.

The announcement, recently made, to the effect that the National Steam Car Company will in future run its fleet of steam omnibuses on coke instead of paraffin as at present, gained additional interest from the fact that it appeared almost simultaneously with an intimation of further adjustments and curtailments in London omnibus services, owing, of course, to the increasing difficulties in regard to petrol supplies. It is not necessary to discuss here how the National coke-fired steam lorry compares with other steam-driven vehicles, but it is clearly the only one now on the market that can seriously be considered for passenger as well as for heavy goods transport. National coke-fired omnibuses have, in fact, been running elsewhere than in the Metropolis for some considerable period, and those familiar with their characteristics and performance clearly foresaw that their introduction to the London streets was only a question of time. Now, after tests extending over a period of twelve months, the Metropolitan police authorities have given the necessary approval, and so far as legal formalities are concerned the way is now clear for the introduction of these vehicles in due course. Their immediate appearance, however, is not to be anticipated. Although the sanction of the Treasury has been obtained for the necessary capital issue to finance this enterprise, the demands, direct and indirect, of the war make it somewhat improbable that any considerable proportion of the company's manufacturing resources can in the immediate future be spared for passenger vehicles. All that is now being done therefore must be regarded as merely preparatory to early post-war operations. The question may arise as to whether the situation as regards petrol may not by then have undergone some modifications, but no one but a very rabid optimist will expect the prices of motor spirit to go back immediately to pre-war level. Even were they to do this, the fact that the steam coke-fired vehicle can be operated at a cost for fuel showing a saving of 60 per cent., as compared with the petrol figures of three years ago, will make the advantages in that respect of this form of transport sufficiently tangible. The National Steam Car Company's London fleet at present numbers 162 omnibuses, all of which are eventually to be converted to run on coke, and 38 vehicles are to be added, bringing the total up to 200. When the conversion is complete it is estimated that there will be an annual saving of £20,000 in the fuel bill, taking last year's figures. This, of course, represents operation on a large scale, but to the smaller user the results should be sufficiently favourable. Even at the present high price of coke, the average fuel cost per vehicle mile is less than five-eighths of a penny. The National coke-fired steam lorry has already rendered excellent service in commercial transport and in municipal work; and the fact that it provides a self-propelled vehicle, suitable alike for passenger or goods work, either in towns or the country, on short or long hauls; that its fuel is, after all, a bye-product—invests it with more than ordinary interest.

WEIGHT OF LONDON OMNIBUSES.

FURTHER REDUCTIONS TO BE REQUIRED AFTER THE WAR.

The following statement has been issued by Sir Edward Henry the Commissioner of Police of the Metropolis:—

"The Commissioner of Police of the Metropolis, as the authority for licensing public carriages, desires to make the following representation with regard to the future construction of motor vehicles intended for licensing as motor omnibuses within the Metropolitan area.

"By the Heavy Motor Car Order, 1904, it is enacted that the maximum unladen weight of a heavy motor car may not exceed five tons, and, if it is to be operated up to 12 miles per hour the registered axle weight of any axle may not exceed six tons. In the past it has been found that the passage through the streets of motor omnibuses approaching the maximum of unladen weight and of permissible speed, caused much annoyance and damage through noise, vibration, etc., though fitted with rubber tyres as provided by the Order.

"Acting upon expert advice, the Commissioner, in 1909, after a conference with manufacturers and users, laid down a rule that no new vehicle would be licensed for public service which exceeded three and a half tons unladen weight, or, alternatively, exceeded a gross weight, fully laden, of six tons. Even with these limitations of weight, complaints of damage and annoyance continue, and the time appears opportune for reviewing licensing requirements, as the demand for chassis and parts consequent upon the war having exhausted old stocks, new constructions will, when circumstances permit, have to be undertaken before new vehicles can be put upon the market.

"The experience and the developments of the last six years in the mechanical properties of materials and in designs of structural details lead the Commissioner to anticipate that it will be possible to construct vehicles to meet the requirements of the public service in London with lower unladen and gross weight than three and a half and six tons respectively. It is well known to manufacturers that since 1909 methods of production of gearing have been developed which will make it practicable to obtain silent and efficient working with lessened total weight of transmission mechanism, and some reduction may be expected in the total weight of power and of transmission mechanism throughout. Attention is also called to the method of inside lighting and of outside advertisements, as it is possible that saving in weight in connection with them might be effected.

"The Commissioner deems it necessary therefore to give timely notice that new vehicles presented for licensing must be of a type differentiated from existing types by being lighter in weight and with a better form of power transmission. He invites the co-operation of manufacturers in designing and constructing vehicles which can operate in the streets without affording grounds for complaints as to the damage done to residential property by the excessive vibration they cause owing to their weight, and as to the annoyance caused by faulty power transmission.

"The interests of the community and of the operation companies in this matter are the same, as the introduction of a perfected type of vehicle would greatly popularise the omnibus service to the benefit of both the operating companies and the public; the Commissioner feels sure that he can in these circumstances rely upon the cordial help of manufacturers. Any representations they may put forward will, of course, receive the most careful consideration."

A MANUFACTURER'S COMMENTS.

SEATING CAPACITY THE DETERMINING FACTOR.

Mr. Sydney Straker, of Straker and Squire, Limited, writes:—

To evolve an omnibus from the development and experience of the last ten years, on a lesser weight than the chassis now employed, on the basis of a vehicle having a capacity of thirty-four passengers, appears to be a difficult proposition. I believe the average weight of a London omnibus is 3 tons 10 cwts. or thereabouts, the chassis weight being about 2 tons 8 cwts. and the body 22 cwts. or thereabouts.

As a matter of fact, in practice the above-mentioned chassis is too light to give the best commercial effect, and could with advantage be increased by 5 cwts. Therefore to meet the view set out in the circular issued by the Commissioner entails the production of a lighter chassis to carry a lesser number of passengers. I suggest this would probably take the form of a chassis weighing 1 ton 15 cwts. and body weighing 15 cwts. to carry twenty or twenty-two passengers, making the gross weight 4 tons.

Were it not for the fact that omnibus companies have always held out for vehicles to carry thirty-four passengers, this vehicle

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would have been produced long since, but I have always understood from directors that any company using vehicles of a lesser capacity could not expect to succeed in its enterprise, so that commercially we have been educated to understand that thirty-four passengers is the minimum capacity for a metropolitan omnibus. If this feature could be adjusted to provide for the lighter omnibuses, no doubt the requirements mentioned in the Commissioner's circular could be met, and unquestionably municipal engineers would be very ready to welcome this proposition.

It is difficult to appreciate the meaning of the circular in respect to transmission. The methods adopted in the bulk of omnibuses employed to-day represent the direct drive through the cardan-shaft, with metal universal joints, which we, as engineers, must consider the latest and most approved method of transmission of power from the motor to the road wheels, unless it is suggested that a method could be adopted to provide for a lesser unsprung weight, in which case experience shows that where omnibuses are produced on the petrol-electric system, embodying an exceptionally light unsprung weight, the damage to the roads is in no degree lessened, and, due to the gross weight being considerably in excess of a petrol omnibus, the inconvenience due to vibration, etc., is accentuated. It is difficult to assume that makers are likely to adopt any other system than the standard petrol vehicle as produced to-day, with the motor in the front and cardan drive. The possibilities of employing electric vehicles with secondary batteries appear negligible, due to the excessive weight which exists with this production. Approximately an omnibus of this type would weigh upwards of one ton over and above the petrol omnibus of the same capacity.

Ignoring the much-vexed question of defective roads, and dealing with those existing to-day, it is a subject of interest to ascertain, since services have been extended twenty miles out of London, what are the features which cause the damage and pot-holes on the present roads. The solution will be found no doubt in providing suitable roads to sustain the weight not only of omnibuses, but of motor traction generally. The present period, in which very limited opportunity exists for making repairs to roads, is somewhat inopportune in respect to securing reliable information as to the amount of damage which is effected. Whether pot-holes are brought about due to excessive speed or excessive weight is an open question, but it is quite evident that to take full advantage of the modern method of motor traction for carrying passengers a reasonable speed must be secured, or the advantage disappears.

It would be of interest to the community if the omnibus companies would express their criticisms upon the circular in question, as it must be obvious to them that a reduction in weight will be essential in order to meet the views set out by the Commissioner.

A ROAD ENGINEER'S VIEWS.

Mr. C. H. Cooper, borough engineer, Wimbledon, writes :—

The memorandum of the Commissioner of Police for London gives " timely notice that new vehicles presented for licensing must be of a type differentiated from existing types by being lighter in weight, and with a better form of power transmission." The reason given for reducing weight is that, even with the existing limitations of a 3½ tons unladen and 6 tons when fully laden, " complaints of damage and annoyance continue."

From these remarks I take it that the primary reason for reducing weight is to reduce the damage done to highways. Ten years ago, we had horse-drawn omnibuses traversing water-bound macadam roads. These omnibuses fully laden weighed little more than half a fully laden motor omnibus. To-day these same roads are traversed by motor omnibuses carrying far more passengers than the horse-drawn omnibuses did. With few exceptions these roads have been surfaced with material capable of carrying motor omnibus traffic, and where so surfaced the cost of maintenance has, as a rule, not increased.

During wet weather a line of motor omnibuses will soon destroy a water-bound macadam road. Early last summer, during a continuous downpour of rain, I was one of the party of members of the Institution of Municipal and County Engineers who journeyed along some ninety miles of the country roads and lanes of Lancashire in twenty chars-a-bancs. The damage done by these chars-a-bancs could not have been repaired for £500.

If the object of the Commissioner is to reduce damage to highways, he should prohibit lines of omnibuses running along macadam roads in wet weather. When a road is properly constructed it matters little whether the omnibuses traversing it weigh six or seven tons each. If this reduction in weight is appreciable, it means that fewer passengers can be carried per omnibus, and therefore more omnibuses will be required, which would add to the present congested state of the traffic in our streets. More omnibuses mean more labour, and to meet the cost of such labour it will in all probability be necessary to raise the fare.

NEW PETROL RESTRICTIONS.

The Petrol Committee of the Board of Trade announced on April 26 that they had been compelled in view of the increasing scarcity of petrol for war purposes to take drastic measures to reduce consumption by owners of private motor cars and motor cycles. The allowance of spirit for a private car used for business purposes is now limited to 10 gallons a month, and the renewal of licences for cars used purely for private purposes has been refused.

The maximum allowances of motor spirit that the committee will be able to grant on the free-of-duty licences to motor cars bearing the hackney carriage plates are as follows :—

30 gallons per car per month where the owner has one car only.
25 gallons per car per month where the owner has two cars only.
20 gallons per car where the owner has more than two cars.

From an average allowance of 60 gallons per month the permitted supply to garage owners is reduced to an average of 20 gallons per car per month. It is also in contemplation seriously to reduce the quantity of petrol for the use of taxi-cabs.

The new regulations will have the effect of putting an end to an abuse. Certain owners of cars had made arrangements with garage owners to evade the regulations by nominally transferring the ownership to the garage, thus securing a hackney carriage plate and an increased petrol supply. No garage company nor owner can now obtain an additional licence ; he is strictly limited to those now in force, with a possibility of a reduction of the number.

For agricultural work as much petrol as is required will be allowed, but the allowance will be made through the Agricultural War Committees, who will have to certify requirements.

PETROLEUM DISTRIBUTION BOARD.

It was announced on April 26 that at the request of the Government the principal petroleum companies have arranged to pool their distributing facilities in this country, and also the tonnage employed in bringing supplies to the United Kingdom with the object of releasing men for the army and effecting economy. A controlling board, with Mr. E. H. Fry (Director of Munitions Petroleum Supplies) as chairman, has been appointed by the Government, the offices being at the Ministry of Munitions, 8, Northumberland Avenue, S.W. The board will have the title " Pool Board, Petroleum Supplies," and will consist of representatives of the following companies :—

Anglo-American Oil Company, Limited.
Anglo-Mexican Petroleum Company, Limited.
Bowring Petroleum Company, Limited.
" Shell " Marketing Company, Limited.
British Petroleum Company, Limited.
Homelight Oil Company, Limited.
Union Petroleum Products Company, Limited.
H. P. Wheatley and Company, Limited.

Mr. A. C. Adams will also be a member of the board, and act as chairman of the distribution committee. All products, except lubricating oils, hitherto delivered under proprietary brands will in future be delivered under war brands and distributed under the authority of the Pool Board. Inquiries with respect to supplies should be addressed, as heretofore, to the offices of the respective companies.

LONDON OMNIBUS REDUCTION.

On April 30 there was a reduction in the motor omnibus services in the metropolitan area for the third time during the past six months. The limitation was due to increased curtailment of petrol and substitutes by the Petrol Committee. As the services are already depleted the management had difficulty in adjusting them with the minimum of public inconvenience while at the same time maintaining full services on munition routes. It had been announced that the chief reductions would be made on tramway routes. Thus the submarine menace has to some extent brought about the avoidance of duplication of services, a matter in which some unsuccessful negotiations were initiated eighteen months ago. The failure was not surprising, for the crowded state of the omnibuses on roads where there are tramways renders it difficult to allege that there is unnecessary duplication, especially as tramway routes constitute only a short portion of any individual omnibus route. It may be urged on behalf of public transit services that the recently imposed regulation forbidding the use of fuel for pleasure riding ought to be thoroughly carried out before the rationing of the former is further curtailed. Certainly it has not been uncommon to find wearers of military uniforms hiring cars for unessential purposes.

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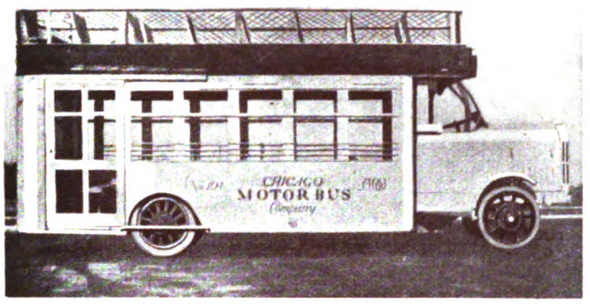
CHICAGO'S NOVEL OMNIBUSES.

STEEL BODIES, AN ENCLOSED STAIRCASE, AND FIFTY-ONE SEATS.

A further addition to Chicago's transportation systems began its initial operation on March 25. This comprises a regular omnibus line service from the loop district north, through Lincoln Park and continuing out the Lake Shore Drive and Sheridan Road to Devon



Avenue, a one-way distance of approximately nine miles. The first fifty vehicles are being received rapidly, and when these are in operation the company expect to be able to give a two-minute or three-minute service from the loop district during the rush hours to points along the north shore. During these rush hours the omnibuses will give express service from the loop to different main points on the North Side, and operate local services beyond these. A 10-cent fare will be charged.

The machines are a marked improvement over those hitherto used in Chicago. The bodies were built by the St. Louis Car Company, and are constructed of steel with the rear stairway to the upper deck enclosed and a sliding door closing off the vestibule. Passengers only up to the seating capacity will be carried, which means 29 on the upper deck and 22 below. The side posts are equipped with push-button signals. Electric lights are mounted in the headlining and supplied with refractors. Operation has been begun as an experiment on the pay-as-you-enter system.

The chassis were built by the Moline-Knight Company, and are rated at 50 H.P. The entire power plant and driving mechanism is mounted on the front axle so that the power unit may be detached from the body and another put in its place in thirty minutes, thus making it possible to keep the body in practically constant service. It is expected that the omnibuses will be able to make 25 miles per hour, but the schedule speeds have not as yet been determined. The vehicles complete weigh approximately 10,000 lb. Apparently pneumatic tires are in use, but this point is not mentioned by the *Electric Railway Journal*, of New York, to which we are indebted for the illustration and description.

A franchise was very recently granted to the same company for a similar line of omnibuses through the South Side parks, and an order for fifty more has been placed. Operation is expected to begin on the South Side during the latter part of the summer. Mr. George B. Crowley is general manager of the Chicago Motor Omnibus Company, and Mr. W. J. Sherwood, formerly superintendent of the Mobile Light and Railroad Company, is superintendent of transportation.

THE PETROL INDUSTRY IN AMERICA.—A Washington telegram states that the Federal Trade Commission in a report presented to the Senate finds that the Standard Oil interest now substantially dominates the gasoline industry in the United States, notwithstanding the dissolution of the Trust. It is declared that the prices have arbitrarily increased, and that no real competition exists to-day in the trade between the various standard companies because of the interlocking with respect to stock and ownership. Fresh legislation is needed.

ENCOURAGEMENT OF RESEARCH.—A million pounds is the sum allotted in the Civil Service Estimates as a grant-in-aid to encourage scientific and industrial research in 1917-18. It will be paid to the account of the Imperial Trust, and any balance will not be surrendered at the close of the financial year. Grants will be made by the directions of a committee of the Privy Council over an agreed period to approved trade associations for research to supplement the funds of the association. Last year a grant was made for research carried out by the Society of Motor Manufacturers.

COKE FUEL OMNIBUSES.

The National Steam Car Company, with the sanction of the Treasury, on April 25-30 offered for subscription 100,000 ordinary shares of £1 each, the proceeds to be devoted to the enlargement of the company's manufacturing facilities, and particularly to the manufacture of coke fuel chassis and the conversion of the company's present steam omnibuses to burn coke fuel instead of imported paraffin. The permission of the Government has been obtained for the construction of fifty new chassis and the conversion of the company's present fleet. The new chassis has been tested under the supervision of the Metropolitan Public Carriage Department for over twelve months, and has so far satisfied the authorities that they have given permission for its use. The invention of this coke fuel motor will, it is claimed, effect a saving of upwards of 50 per cent. on fuel even at pre-war prices. The company at present own 172 steam omnibuses, 162 being operated in London and 10 in Chelmsford. It is intended to bring the London fleet up to a total of 200 omnibuses as soon as possible. Mr. Thomas Clarkson, chairman and managing director of the company, in his report to the directors, states that a number of National coke fuel lorries that have already been supplied have given much satisfaction. They are as light, speedy, and quiet as petrol lorries.

REMARKABLE GARAGE EFFICIENCY.

CHALLENGE SHIELD OF THE LONDON GENERAL OMNIBUS COMPANY.

The London General Omnibus Company have long encouraged garage efficiency and the competitive spirit, and very excellent results have been attained in various directions. The latest development is an award of a challenge shield to the garage holding the record for the fewest number of lost miles in any given year.

At a recent meeting at the "Albert Stanley" Institute, Hammersmith, attended by over 500 officials and employees, the shield for 1916 was presented to Hammersmith Garage, for a record of 203 consecutive days without a single lost mile, the only exception allowed being a period of very heavy fogs at the latter part of last year. The chair was taken by Mr. G. J. Shave, the manager for maintenance, who commented upon the spirit of co-operation between

the Operating and Engineering Departments, which alone made possible such an admirable record.

The presentation to the garage staff (represented by garage superintendent J. Cameron and operating foreman G. Watson), was made by Mr. H. E. Blain, the operating manager, who referred to various records held by different garages of the company and to the great interest taken by the employees in efficiency work. He also alluded to the fact that both Mr. W. H. Smith (district engineer) and Mr. J. Green (district operating foreman), when they were garage superintendent and operating foreman respectively at Hammersmith, had laid the foundation of this excellent record, but they had since been promoted to higher positions with the company.

Pleasant variation was given to the notable gathering by the excellent musical programme submitted by the concert party of the Hammersmith Garage.

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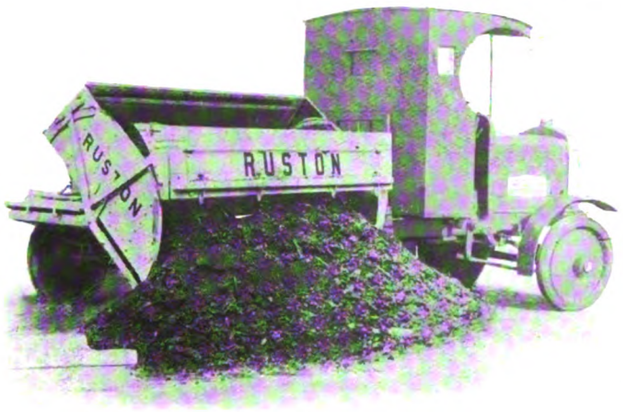
MOTOR TRAFFIC.

STRAKER-SQUIRE TIPPING WAGON.

An improved type of tipping wagon has recently been placed upon the market by Straker-Squire, Limited, of Nelson Square, Blackfriars, S.E. The machine has a number of features that should recommend it to municipal authorities. The body was constructed by Ruston, Proctor and Company, Limited, of Lincoln, under the "Constable" patents, and is designed to fit the Straker-Squire standard 5-ton chassis. The advantage of this arrangement is that no shortening of the frame is necessary, which therefore remains standard and suitable for the fitting of other types of bodies at any time when desired. This feature is obtained by reason of the fact



Tipping Wagon Arranged for Side Tipping.

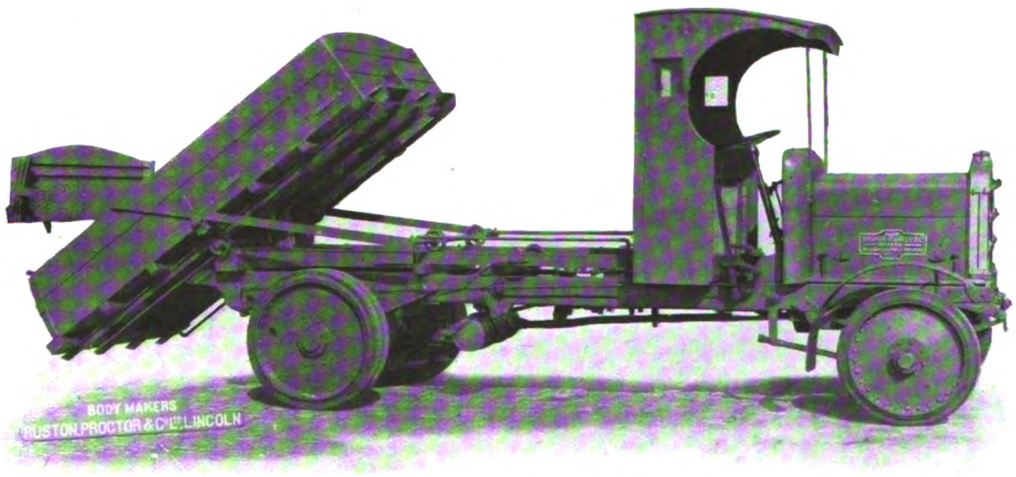
that the tipping body is so designed that it travels several feet in a horizontal direction before it tips. This arrangement also gives the additional advantage that in the running position the load is well forward of the rear axle.

The operation of tipping is extremely simple, and can be completely carried out by one man in two minutes. A quick pitch screw traverses the body on anti-friction rollers along the frame until a point is reached where the body and load balance about the centre. Toggles then come into action to control the tipping operation, which takes place by gravity. The movement being at all times under the control of toggle links actuated by the screw, the man does not have to lift the load at all when tipping, and the action is free and rapid. An angle of 50 degrees is obtained, which is sufficient to completely discharge any class of material.

An important feature of the wagon is the automatic opening of the tailboard. With ordinary tipping bodies it is necessary to remove the tailboard before tipping, and this is frequently a somewhat difficult operation owing to the liability of the tailboard to become jammed as a consequence of its being damaged by being carelessly thrown down after removal. With the "Ruston" tipping body the tailboard is permanently attached to two bars turning on a pivot in the centre of the body. Its near face is set at such an angle that it lifts clear away from the load without jamming as the body tips.

The illustration below shows how the end of the body drops away from the tailboard, leaving a perfectly free and very wide opening, through which the load is instantly discharged. The capacity of the standard body is five tons of coal, earth, stones, or similar material, but extensions to the sides are provided, giving greater carrying capacity when light bulky loads have to be transported. The other illustration shows the wagon arranged for side tipping. This design is equally reliable; the principle is the same as in the case of end tipping, with the necessary mechanism adapted for the purpose.

The general dimensions of the chassis are as follow:—Overall length, 20 ft.; width, 7 ft. 2 in.; wheel base, 14 ft.; and length from dashboard to rear of frame, 15 ft. 10 in. The frame is strongly constructed of pressed steel, the centre of the side members being 8 in. in depth. The engine is of the 4-cylinder type with cylinders cast in pairs, 4½ in. bore by 6 in. stroke. All the valves are interchangeable, are situated on one side, and operated by one camshaft. The gear box gives four speeds with direct drive on top, the ratio between top and bottom speeds being 4 to 1. Cast-steel wheels of standard size are fitted.



Tipping Wagon Arranged for End Tipping.

COMMERCIAL MOTOR USERS' ASSOCIATION.

Colonel R. E. Crompton, C.B., chairman, in presenting the annual report of the Commercial Motor Users' Association at the fourteenth annual general meeting, referred to the close touch which the association kept with the naval and military authorities, giving its assistance to these services on many occasions.

The association had been successful during the year in securing the abandonment of the proposed additional tax of 3d. a gallon on petrol for use in commercial motors, and had successfully urged that, in view of the great difficulty in securing supplies of coal for steam wagons owing to the great demand by the navy, the Home Office should allow a considerable degree of latitude in the event of the emission of smoke before taking legal action.

An important appeal case had been won, in which it was sought to prove that a steam wagon was a locomotive, and every Order and Regulation affecting commercial motor interests had been investigated. He drew attention to the rapid increase in membership, which during the past six years had increased from under 300 to nearly 2,000 users, representing over 30,000 commercial motor vehicles.

The following resolution was unanimously carried:—"The Commercial Motor Users' Association is in favour of the Channel Tunnel scheme, subject to the consideration of national defence being settled in the affirmative by the competent naval and military authorities."

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MOTOR TRAFFIC.

THE COMMERCIAL VEHICLE.

PRESENT CONDITIONS AND AFTER-WAR PROSPECTS.

Mr. H. C. B. Underdown, managing director of Commercial Cars, Limited, contributed to the April trade supplement of *The Times* an article on the above subjects. From it we make the following extracts:—"Every motor manufacturing shop in the kingdom has been working day and night practically since the outbreak of war. In August, 1914, the commercial vehicle side of the industry was comparatively speaking less important than the pleasure car industry. The war has altered that, and the commercial vehicle, which had already "made good" before the war, has far outstripped the pleasure car as a factor in the activities of our national life. Just as at the front the motor lorry has acted as a link between the railway terminus and the fighting line, so in the future it will help to solve the transport problems of this and other countries. With very few exceptions those firms engaged on the production of pleasure cars are now engaged upon other work. On the other hand, commercial vehicle manufacturers continue to turn out their own manufactures. Consequently, while the general effects of the war have been the same in both cases, in certain respects they differ considerably. Both have been suspended from doing ordinary business with customers except in very few instances; both have suffered great loss of goodwill, particularly in the colonies and foreign countries; both have invested their profits in buildings, plant, and machinery, the value of which after the war is problematical, and both are, of course, subject to the excess profits tax and munitions levy.

WAR VEHICLES' EXCELLENT MAINTENANCE.

"The commercial vehicle manufacturer is confronted with a danger arising from the very fact that he has continued to produce lorries on an ever-increasing scale. These lorries are practically all of one type and load-carrying capacity. They have been poured into the theatres of war accompanied by thousands of American-built lorries of similar type, and a very large number of them will come back when peace comes. It has often been said that the wear and tear and destruction caused by the war have been so great that this point can be ignored, but it can be stated as a fact that the maintenance of these lorries has been, and is being, so admirably carried out that the numbers which will have to be disposed of after the war will certainly aggregate very many thousands. Even allowing for the large demand for commercial vehicles which will be called for by the period of reconstruction, it is obvious that the disposal of their new productions alongside of these returned lorries after the war must be a matter of the gravest concern to commercial vehicle manufacturers.

After the war the British motor manufacturer will be confronted with the most intense competition, particularly from America. The American maker's financial resources, unaffected by excess profits tax, will make him a most formidable opponent for the British motor industry with its depleted cash resources and its capital tied up in buildings and plant.

BRITISH POLICY AFTER THE WAR.

"The Association of British and Allied Manufacturers, representing practically the whole of the British motor car manufacturing industry, recently issued a statement of policy embracing proposals for a heavy import duty on foreign motor vehicles, with a preferential tariff in the case of the Oversea Dominions, the improvement of the Consular service, the alteration of banking methods, and emphasised the necessity of arrangements designed to prevent war service vehicles being thrown unrestrictedly on the market. It also associated itself with the recommendations put forward by the Federation of British Industries for the development of the Government service for the promotion of British trade in foreign countries under the Foreign Office.

"Assuming that a tariff is created to help the motor industry, it is, in the writer's opinion, essential that the industry itself should take to heart the lessons of the past, lessons which the war has clearly shown can no longer be ignored. It must set to work to introduce methods altogether fresh to the minds of many engaged in it. Too much reliance must not be placed on Government assistance, vital though this will be. Competition between firm and firm in the same line of business must give way to co-operation, specialisation, and organisation of the highest order.

"Employers must encourage labour to see the folly for all concerned of restricted output by themselves taking a far broader view of the rights of labour. Distrust must give way to friendly co-operation. It should not be a difficult matter to evolve a scheme of collective action, financial and otherwise, which would enable the industry to fight foreign competitors."

OXFORD OMNIBUS APPEAL DISMISSED.

In the Court of Appeal on April 24, Lord Justice Eady, Lord Justice Scrutton, and Mr. Justice Bray, heard the appeal of the Oxford Tramways Company, Limited, against the decision of Mr. Justice Sankey, awarding £350 to the Abingdon Rural Council for the cost of repairs rendered necessary by the extraordinary traffic of a service of motor omnibuses. His lordship held that the mere demands of the district for traffic which was extraordinary could not turn that traffic into ordinary traffic, although the traffic might be necessary traffic, and might in future become ordinary traffic. The evidence and judgment were reported in our issues of November 18 and December 7 last.

In the Appeal Court Mr. Disturnal, K.C., and Mr. Eustace Hills appeared for the appellants; Mr. Clavell Salter, K.C., and Mr. Willoughby Williams for the respondents.

Without calling on the respondents their lordships dismissed the appeal.

Lord Justice Swinfen Eady said that the claim was brought under section 23 of the Highways and Locomotives (Amendment) Act, 1878. It was beyond dispute that the traffic had caused a large extra expense, amounting to £104 a mile. But the defendants said that it was not extraordinary traffic within the meaning of section 23 of the Act of 1878. The company in 1914 established a service of motor omnibuses. Previously there had been a service of one-horse omnibuses. Defendants' omnibuses weighed when empty from 3 to 3¼ tons, and when loaded from 4 tons 7 cwt. to 5½ tons. There was a daily service. During the day one omnibus started every hour from each terminus. There were 24 omnibuses passing over this road every day, or about 168 in a week. The court was urged to consider the nature of the neighbourhood and the nature of the roads, but that had been considered by the learned judge. This was an entirely new service, and was quite different from the service previously in existence on these roads. The question was whether this traffic was extraordinary traffic within the meaning of section 23 of the Act of 1878. His lordship referred to Hill *v.* Thomas (9 *The Times* Law Reports, 647; [1893] 2 Q.B., 333), and said that the traffic was additional traffic and was of an entirely novel character. It was not traffic which had grown or had gradually increased. It was a service of motor omnibuses put on a country road where the ordinary traffic did not comprise traffic of a similar nature. Mr. Disturnal had raised the question whether an omnibus service run to serve the needs of the district was an extraordinary service. He contended that if all that these omnibuses did was to satisfy the needs of the district and to carry passengers to Abingdon and Oxford, then it ought not to be regarded as extraordinary traffic. In his lordship's opinion such a contention could not be upheld. His lordship referred to Lord Buckmaster's judgment in Barnsley British Co-operative Society (Limited) *v.* Worsborough Urban Council (32 *The Times* Law Reports, 41; [1916] 1 A.C., 291, at pp. 299, 300), and said that that service of omnibuses was not the "slow and normal increase of the development of traffic owing to the development of the district," but it was substantially put on at one time and was wholly different in character from the previous traffic. It was contended that when traffic once became extraordinary traffic it was always extraordinary. His lordship could not accept that contention. They were concerned only with the traffic during the one year before the commencement of the action, and they were not concerned with the point whether traffic which was extraordinary traffic during that period would at some later period become extraordinary traffic (from *The Times* Report).

ELECTRIC VEHICLE PROGRESS.

The last quarterly issue of the *Electric Vehicle* states that the number of such vehicles in use or on order is now 914, as compared with 150 in 1914. Since the previous issue of the journal 48 vehicles have been ordered, including nine by seven municipal authorities. In addition, 16 firms have given repeat orders for electric trucks and other vehicles in numbers that cannot be stated. Among the contents of the issue are an abstract of a paper on "Electric Vehicles and Their Application," which was read by Mr. L. Brockman before the Institution of Engineers and Shipbuilders in Scotland. In the discussion the paper was referred to by Mr. Lackie, electrical engineer to Glasgow Corporation, as the most complete paper on electric vehicles that has been given in this country. Dover's experience of fifteen months' use of five battery vehicles for the collection of house refuse is given in a report by the deputy borough engineer. The total cost was 3s. 9·98d. per ton, as against 6s. 2d. per ton by horses and carts. Two years' experience of the use of a 1-ton electric is recounted by the West Ham Corporation electrical engineer.

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MOTOR TRAFFIC.

LONDON SAFETY FIRST COUNCIL.

At a meeting of the above Council held on April 18 at the Guildhall, Westminster, Sir Edward Smith, L.C.C., presided over a large attendance, representative of local authorities, Middlesex County Council, tramway and omnibus and railway undertakings, various associations, vehicle employees, unions, commercial firms, and the Metropolitan and City Police forces. Since the last meeting the following bodies had joined the Council and elected representatives:—East Barnet, Shoreditch, Stepney and Wood Green Councils, Institution of Municipal Engineers, and Middlesex County Council.

The Street Dangers Committee presented a report (which was approved) containing recommendations on the following subjects:—Street refuges, lighting of street obstructions at night, snow cleansing, whitening of kerbs, and diminished lighting. The latter subject included the need of discrimination of side streets from main thoroughfares and of making gradual the transition from brightness to comparative darkness at busy junctions by increasing the candle power of the lamps in side streets as the main streets are approached This is already done in some districts, and without such an aid drivers are apt momentarily to be dazzled when passing from a comparatively dark area into a relatively bright one.

On the recommendation of the General Purposes Committee the appointment of an Industrial Safety First Committee was authorised to extend safety principles among those engaged in industrial enterprises.

The Drivers' Educational Committee reported having issued their first leaflet, entitled "Hints to Drivers," setting out clearly the rules of the road. The committee are also preparing a cinema film dealing with all forms of traffic for educational purposes.

The Council was resolved to communicate with the police suggesting the more stringent enforcement of the bye-law on the standardisation of the positions of front and rear lights on all classes of vehicles and on cycles.

A representative committee was appointed to deal with safety first on railways.

STANDARDISATION IN MOTOR ENGINEERING.—The general question of standardisation in motor engineering is now under the consideration of the Technical Committee of the Motor Industries. This committee was recently formed by the Society of Motor Manufacturers and Traders and the Institution of Automobile Engineers. The committee are also considering two special subjects for research suggested by the Commercial Vehicle Committee of the Society. The Commercial Vehicle Committee are acting with the Engineering Standards Committee on the standardisation of wheels and of solid tire bands for same.

ECONOMY OF MOTOR VEHICLES IN CALCUTTA.—The deputy chairman of Calcutta Municipal Council has reported upon the results of the use of a Thornycroft lorry which was introduced on April 1, 1915, for the removal of carcases. So economically and promptly did the vehicle per form its task that a second lorry has since been put into service. For ten and a half months the cost of one lorry on this work has been Rs. 4,900, as against Rs. 14,700 for carts. Adding Rs. 1,600 for depreciation, it is estimated that the annual cost of one lorry will be Rs. 7,300. The receipts for the removal of carcases have increased from Rs. 200 per month a year ago to Rs. 620 per month.

AUSTIN LORRY AT LIVERPOOL.

The Austin lorry shown in the accompanying illustration was recently supplied to the Imperial Tobacco Company by Messrs. J. Blake and Company, the Austin Motor Company's agents for

Liverpool. It has a capacity of from two to three tons, and is fitted with a van body. The special type of frame made by the Austin Motor Company for covered vehicles is clearly shown, and also the propeller drive to each rear wheel.

NAPIER FOR GOVERNMENT WORK.

The Lang Propeller Company, Limited, Weybridge, have secured a 30/45 cwt. lorry, shown in the subjoined illustration, from D. Napier and Son, Limited. It is well known that Napier business vehicles

are being taken by the Government, and it is only in the case of firms engaged on urgent Government work that release can be granted.

The Lang Propeller Company, Limited, are at present busy on urgent Government requirements, and they felt the necessity of an efficient road vehicle to overcome the difficulty of railway transport.

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MOTOR TRAFFIC.

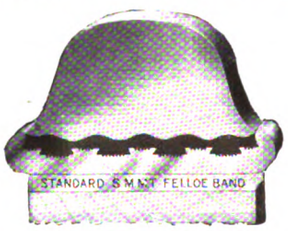
DENNIS SUBSIDY LORRY AT SINGAPORE.

Messrs. Wearne Brothers, Limited, of Singapore, agents of Dennis Brothers, Limited, of Guildford, have received the following letter from Messrs. Lim Nee Soon and Company respecting a Dennis "A" type subsidy lorry supplied to the firm fifteen months ago. The vehicle, which is shown in the accompanying illustration, is constructed to War Office requirements. The chief partner of the firm writes as follows:—"I have now had the subsidy type Dennis in daily use for thirteen months carrying pineapples and rubber from

my plantation to Singapore Town. During this time I have not had a moment's trouble on the road. I consider it the finest commercial vehicle in the world. I have now two of these machines in daily use, and as I require a third to cope with my growing output of rubber, I would like you to place an order with the factory for another subsidy type chassis to be delivered as soon as a permit for export can be obtained from the Ministry of Munitions. After my last experience of the reliability of the Dennis, I will not consider any other make."

PROTECTED BASE TIRES.

An improvement of first-class importance will be noticed in the B. F. Goodrich Company's "P.B." (protected base) tire, of which an illustration is given below. By inadvertance this illustration appeared in our issue of April 12, with the description of the Goodrich demountable tire. Rectification of the error now affords an opportunity for directing attention to the claims of the millimetre "P.B." tire, which is manufactured in sizes that conform to the requirements



of the Society of Motor Manufacturers and Traders. Three of the advantages of the protected base tire are given below:—

Better Union between Rubber and Steel.—The upturned sides provide the necessary scope for locking rubber and steel in the vice-like grip shown in the illustration.

Protection against Side-blows.—The power of the upturned steel sides provides adequate protection against the inevitable blows from kerbs, car rails, loading platforms, etc.

Greater Strength.—The whole construction of the steel base of the "P.B." tires makes for increased strength—apart from the extra amount of steel, the sides are so constructed as to yield the utmost power of resistance.

Mechanical Traction Insurance.—It was stated by Mr. E. Roger Owen, chairman of the Ocean Accident and Guarantee Corporation, Limited, at the annual meeting on April 3, that the company had a large and increasing motor department. The management had built up an organisation that enabled them with the greatest efficiency to meet every requirement of mechanical traction insurance. In all departments their foreign and colonial business continued to progress satisfactorily. Sir Clarence Smith and Mr. J. S. Smith-Winby were re-elected directors.

MOTOR VEHICLES FOR MUNICIPALITIES.

Derby Council have obtained an electric tipping wagon from the General Vehicle Company.

Kettering Council have obtained a 3½-ton G.V. battery wagon with tipping body from the General Vehicle Company, Imperial House, Kingsway.

Hull and Battery Vehicles.—Councillor J. Pybus, chairman of Hull Electricity Committee, has suggested that the Corporation should follow the example of other large towns and embark upon electric lorries instead of horses and dust carts, and for other purposes. Battery vehicles, he added, had proved a financial success from a health point of view.

Shoreditch Council, after experimenting with a hired 5-ton steam wagon for the removal of clinker and ashes from their generating station, have purchased a second-hand Foden 5-ton steam wagon and two 4-ton trailers. The cost will be recouped in little more than a year's working. The vehicles will effect a further saving in removing clinker from the dust destructor, and they will also be available for coal cartage.

Wolverhampton Council have allotted contracts to the General Vehicle Company for a 3½-ton electric vehicle at £1,220, and to Mossay and Company, Limited, for two 3½-ton Orwell machines, at £855 each. The Chloride Company have an order for an Ironclad Exide battery for a delivery van at £142. Mr. S. T. Allen, chief engineer and general manager of the Corporation electric supply department, already has three battery conveyances at work, and it was on his recommendation that further contracts were placed.

MOTOR TRAFFIC NOTES.

Lack of Spare Parts in Australia.—Adelaide's city engineer in a report on the work of four motor lorries in his department during the past year, states that spare parts were not obtainable during the war, and most of them had had to be manufactured.

Batteries for Australian Electrics.—In the early part of 1916 an electric sweeping machine belonging to Adelaide Council was put out of commission on account of batteries not being obtainable in Australia. A contract has since been let for the supply of new batteries.

"Stop Traffic" Marks on Road Surfaces.—Adelaide Corporaton during 1916 took various measures to relieve traffic congestion in the business centre. At the busy places "stop traffic" marks have been put on the roads to assist the police in controlling the traffic. A similar step was taken at tramway stopping-places.

Tire Equipment in the War.—The Solid Tire Committee of the Society of Motor Manufacturers and Traders have held special meetings to deal with matters arising out of the report of their deputation to France to inspect tire equipment in war service. The results are likely to prove valuable not only to manufacturers, but also to the War Office.

Omnibus Services Curtailed.—In consequence of the further limitation of the petrol supply, omnibus services have been curtailed all over the country. In London there are now fewer omnibuses running on tramway routes. In Birmingham the Corporation have partly withdrawn services from a residential district in order to maintain those for munition workers.

Motor Vehicle Depreciation.—In a reference to the allowance for the depreciation of motor vehicles at a meeting of the Commercial Motor Users' Association, Colonel Crompton, chairman, stated that the effort to obtain better terms had to be dropped. Only one-fifth of the membership replied to the committee's letter. A member mentioned that the surveyor of taxes in his district was only allowing 10 per cent. on the written down value, whereas previously the amount was 15 per cent. on the purchase price.

The Suggestion for Omnibuses at Chester.—In introducing the Finance Committee's estimates at a meeting of the Corporation, Alderman D. L. Hewitt referred to a suggestion that the tramways undertaking should be replaced by omnibuses in consequence of the large amount now necessary to be spent on repairs. He stated that such a change was not one to be undertaken lightly. The authority purchased the tramways for £18,000, of which sum £8,000 was for land and buildings. With the electrification in 1903 the total expenditure had been £83,000, the amount of loan repaid had been £19,744, the reserve fund amounted to £10,000, and the depot and land were valued at £10,000. During the past year the sum of £1,839 was provided for sinking fund and interest, and £1,839 carried forward. If the undertakings were abandoned there would be a loss of £46,000, in addition to which £50,000 would have to be expended on removing the rails and relaying the roadways.

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THE Tramway & Railway World
WITH MOTOR TRAFFIC SECTION

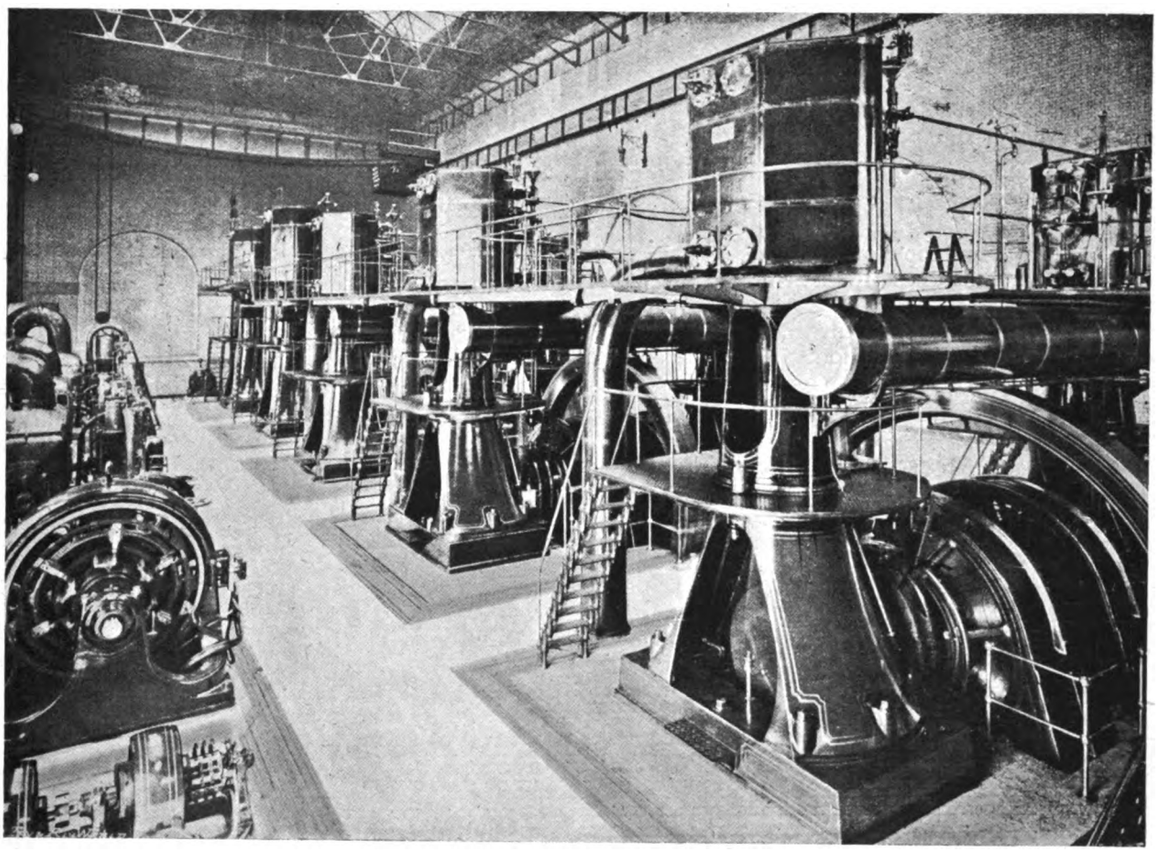
Founded 1892. LONDON, JUNE 14, 1917. VOL. XLI.

LONDON COUNTY COUNCIL TO ACQUIRE PART OF LONDON UNITED TRAMWAYS

A PURCHASE NOT DICTATED BY TRAFFIC OR FINANCIAL CONSIDERATIONS.

Elsewhere in this issue the details are given of the arrangement under which the London County Council will acquire possession of the part of the London United Tramway system which is within the county of London and of the tramway company's power-station at Chiswick. For tramways extending over 5½ miles of route, mostly double track, and for the power-station, which, by the way, the Council did not want and do not need, payments have to be made amounting in all to £320,899, making the average cost to the Council £58,345 per route-mile. In spite of the fact that the tramway company are to supply electricity gratis for working the lines, the estimate is that the operation will result in a loss of about £4,000 a year.

The lines purchased, or part of them, are the successors of a portion of the old West Metropolitan Tramways, which date back to the year 1881. In 1894 the London United Tramways Company was organised and took over the then existing horse tramway system, which was gradually extended. After many difficulties with local authorities and other bodies, electric traction was authorised, and in 1901 the overhead wire system came into operation. The prejudices and difficulties which the late Sir Clifton Robinson and his associates had to overcome in thus inaugurating the first tramway on the trolley system in the London district were enormous.



Interior of Engine and Dynamo Room—Chiswick Power Station, London United Tramways.

The original electric track was laid with girder rails 36 ft. in length, weighing 92½ lb. per yard, resting on a concrete foundation, and was paved with stone and wood setts. The extensions of later years were of a heavier construction. In recent times much of the

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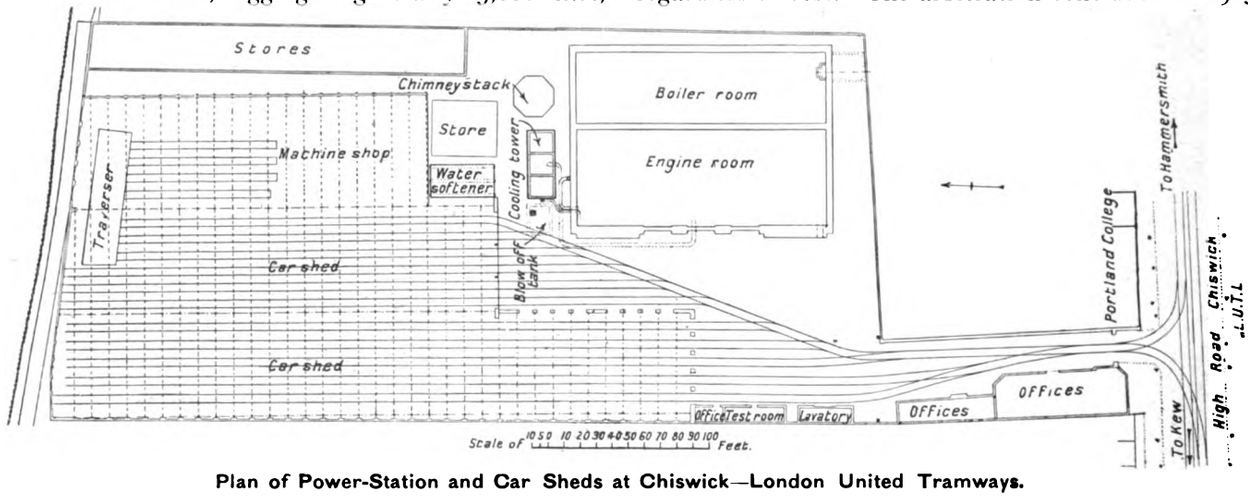
old track fell into a bad state, and as the certainty of purchase by the Council of that part of the undertaking within the county of London came into view the Council contributed to the cost of reconstructing part of the purchaseable lines to the extent of £63,899. This sum is included in the present total, as well as £12,000 of the company's costs and £10,000 of the Council's costs of arbitration of a special case in the High Court. Excluding these items, the net purchase price is £235,000.

The Chiswick power-station at the time it was erected was considered a model installation. There were five vertical cross-compound Corliss condensing engines of American make, aggregating nearly 5,000 H.P., some of them driving direct-current dynamos for supplying the nearer parts of the lines and others driving three-phase generators for producing current for transmission to sub-stations, which in turn fed the trolley wires on the further sections. The detail arrangements were elaborate, and, indeed, the company spared no pains to provide a station that should be as efficient as was then possible. The whole installation was admirably carried out, and from a technical point of view it was a thoroughly creditable undertaking.

The portion of the line that the County Council is purchasing is only a small part of the company's undertaking. It is not in any way essential to the Council's system; it will add a large sum to the enormous capital invested in the Council's enterprise; and it is not expected to be profitable. The explanation of the purchase is that the Council of former years set up a principle which may be variously described as a fetish or an ideal that all tramways in their area must be owned and worked by them. This principle appears in this case to have been carried out to the bitter end regardless of cost. The arbitration concluded in 1913, but it is only recently that ratepayers have had an opportunity of understanding the full significance of the purchase. When this was decided upon it was pointed out in vain that the proposal to buy the part of the lines in London was inequitable, because while that part was only some five miles long, the rest of the system measured forty-eight miles, and because the company would be deprived of the part having the

Exterior of Chiswick Power Station.



Plan of Power-Station and Car Sheds at Chiswick—London United Tramways.

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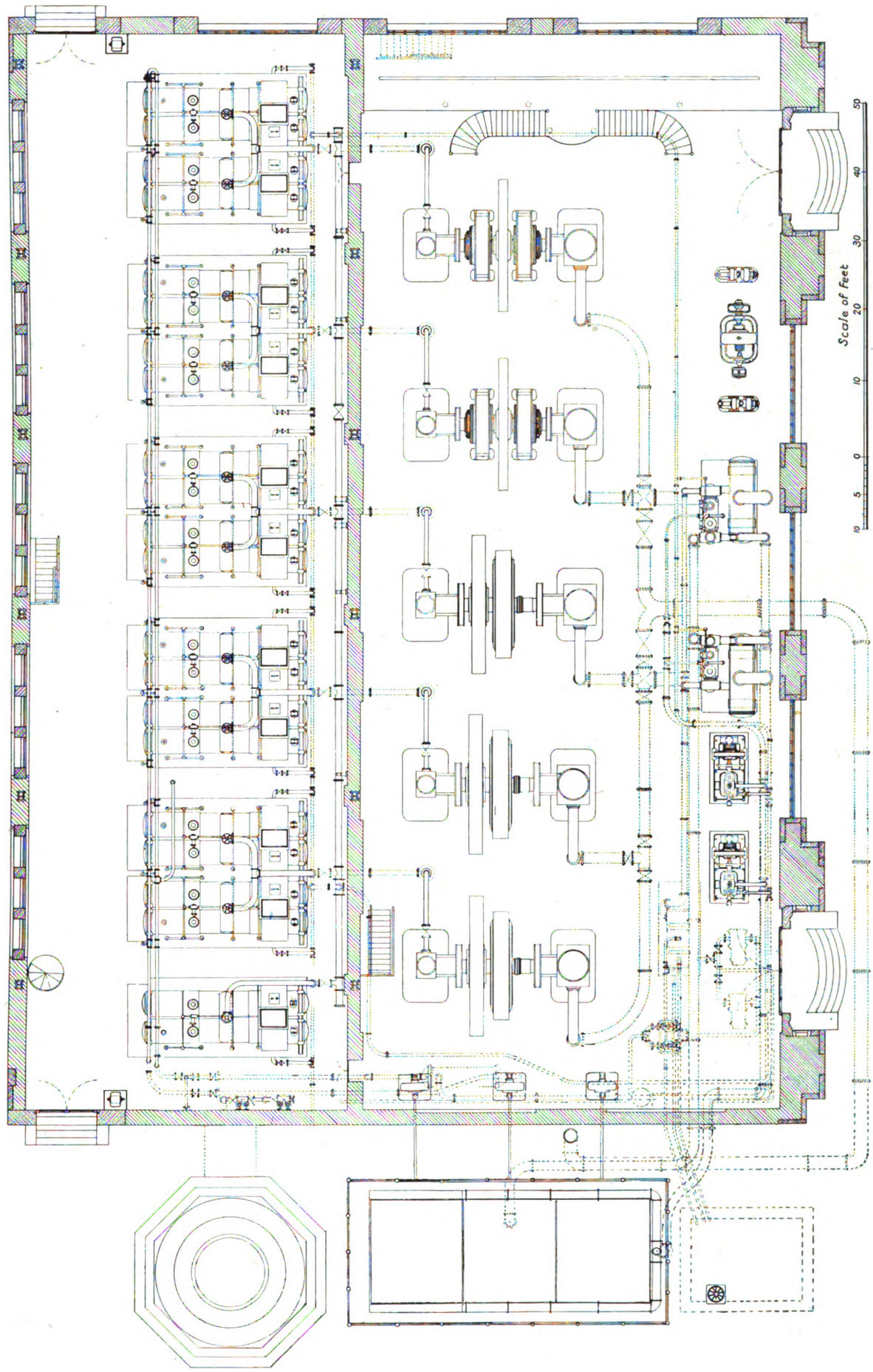

Plan of Chiswick Power-Station, London United Tramways, Built in 1901, to be Purchased by the London County Council and Dismantled.

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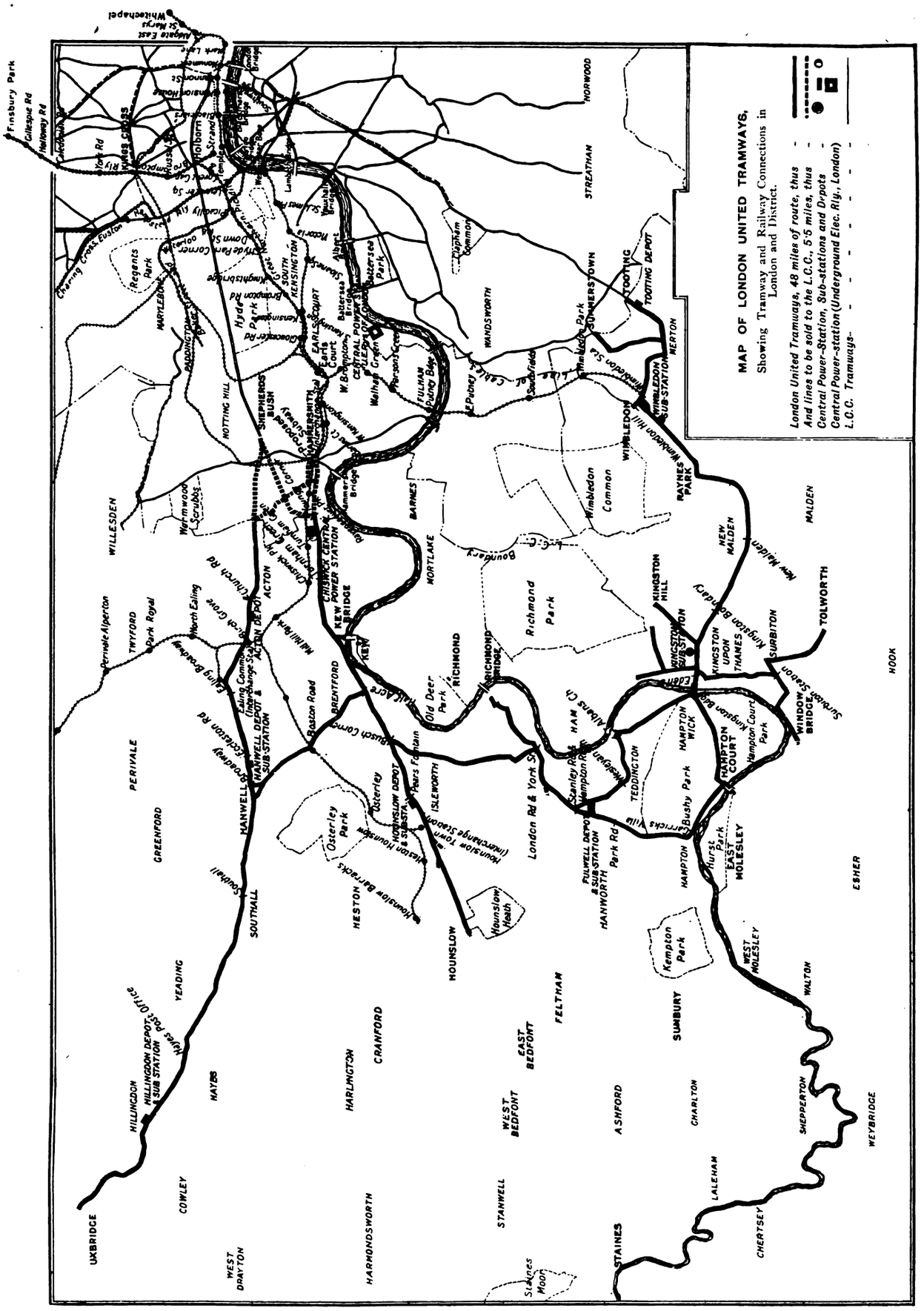

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heaviest traffic. Then the company contended that if their lines in London were to be taken away the Council should also buy the power-station. The Council did not want to buy the power-station, but the contention of the company was upheld, and the Council was forced to do so.

The undertaking is now in a stronger position than it would otherwise be owing to its association with the Underground Electric Railways Company of London, and apparently it will now take all the energy for working the system from the Chelsea power-station, which supplies the underground railways. The company are to have running powers over the purchased lines, which is something, while they will give the County Council free the supply of energy for their cars. The Council will also be entitled to run cars over the company's lines. On the whole the company's position will not be so much worsened as might have been feared, and the facilities for the travelling public have been safeguarded.

It is the County Council, their tramway system, and their ratepayers that will suffer. Their tramway system is at present unremunerative, and this additional burden is to be added as soon as the war is over. If the purchase of the London United lines was going to open up a new system of through tramway communication the case might be different. But no advantage of that kind can be anticipated, at least for years. The only line of the Council's tramways with which a junction can be made is that running from Putney north through Hammersmith and Shepherd's Bush to the Harrow Road. This line is isolated from the rest of the Council's system except for its connection with another purely suburban line through Wandsworth and on to Tooting. No important through traffic can be expected on such a route. If the hiatus in Wandsworth is filled in, cars may be run from the London United routes round by Putney and Wandsworth and so to Westminster and the Victoria Embankment—rather a circuitous way and missing the important centres. In fact, through running on a big scale can only take place when tramways are laid from Hammersmith and Shepherd's Bush direct eastward into the heart of London. Of permission being obtained for that there is no present prospect.

In any event, it is plain that this section of tramway and the power-station (which it is in contemplation should be dismantled and the equipment sold for what it will fetch) will from the financial point of view be an incubus on the County Council's undertaking for years.

Since the above was written a receiver has been appointed at the instance of the debenture holders of the company. This will not, of course, affect the arrangement with the London County Council.

ST. PAUL RAILWAY ELECTRIFICATION.

Progress of the Work.

Particulars were given in our issue of March 15 of the plans that had been adopted by the directors of the Chicago, Milwaukee and St. Paul Railway for the electrical equipment of a further portion of their main line from Othello, Washington, to Seattle and Tacoma, a distance of about 250 miles. The preliminary work has now been carried out, and actual construction is about to begin. Contracts have been made with the Intermountain Electric Power Company, and energy will be supplied by them through eight sub-stations, the equipment of which will be similar to those on the previously electrified section from Avery to Harlowton, which was described in our issue of February 11, 1915.

Specifications for the sub-station machinery and locomotives have been issued, and tenders will shortly be received. The erection of the overhead equipment is about to be commenced, and it is expected that the first section between Othello and Cleelum will be ready for operation by January 1, 1918, and the whole line to Tacoma by January 1, 1919.

NEW TYPE OF CENTRE-DOOR STEPLESS CAR.

During the past few years American tramway companies, as those in this country, have had to meet heavy increases in working expenses which have been due to higher wages and increased cost of materials. In the endeavour to cope with the new conditions, American managers have made more strenuous efforts to reduce expenditure by economies in operation, and greater attention has been given to the study of traffic conditions.

The Boston Elevated Railway Company, who operate a large system of tramways, are among those which have made a fresh study of traffic conditions, and as a result they will soon place in service one hundred cars of the type shown in Fig. 1. Describing this new centre-door stepless car in the *American General Electric Review*, Mr. J. A. Queeney says that many facts which have not hitherto been fully appreciated by the management of traction undertakings, have been taken into consideration. Some of these factors are the power required for even a comparatively slight increase in the schedule speed in a service with frequent stops, the number of stops, the effect on the actual power cost due to the time required for passengers to enter and alight from the cars, the value of automatic acceleration, and the importance of coasting.

Provision has been made for working the new cars in trains when desired for automatic acceleration, rapid acceleration and retardation, rapid loading and unloading, automatic starting signals when the train is standing, and the automatic coupling of the cars. The advantage of coupling motor cars has already been experienced in this country, notably in Newcastle, and it is interesting to learn that the Boston company fully recognise the saving to be derived from the working of trains consisting of several motor cars. In city services multiple-unit trains with a prompt and positive acceleration and deceleration are specially useful in handling large crowds from factories and congested districts during the rush hours. The arrangements with the Boston company provide for running single cars during certain hours of the day, with two-, three-, or even four-car trains when traffic is unusually heavy. The following table presents some of the principal conditions of working :—

Total weight of car with average load ...	52,000 lb.
Number of motors per car	4
Diameter of car wheels	24 in.
Length of route in tunnel	3·45 miles
Length of route in street...	5·195 miles
Time of journey	45 minutes
Average number of stops per mile ...	5·5
Average duration of stops	10 seconds
Maximum grade	700 ft. 6 per cent.
Average rate of acceleration ...	1·75 miles per hour per second
Average rate of braking	1·75 miles per hour per second

A number of trailer cars of practically the same design as the new motor cars have been in service for some time, and have been found very satisfactory. The facilities for loading and unloading are specially noticeable. Both the trailer cars and the new centre-door cars have 6 ft. 6 in. openings with two sliding doors, through which three passengers may enter abreast. These doors are pneumatically worked and controlled through a valve operated by the conductor through a system of levers. It is estimated that the cars can be loaded at an average rate of 0·69 seconds per passenger. Consequently a faster service can be obtained with the new type of car.

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The motor equipment consists of four G.E. 247 motors (Fig. 6) and Sprague GE type P.C.-5 automatic control, which is suitable for either single-car or train operation. This equipment provides for the maximum rate of acceleration consistent with the comfort of passengers and for a maximum speed adapted to economical operation and traffic conditions. The motors are of the ventilated commutating-pole type with a control system having a definite sequence of contactor operation with no interlocks on the contactors. The motor, the general characteristics of which are shown in Fig. 3, is rated at 48 H.P. at 600 volts, and weighs 730 lb. complete with axle, linings, gear cover, and gearings.

In Fig. 4 is shown the high schedule speed possibilities of a car equipped with four of these motors. The control will be operated from a storage battery.

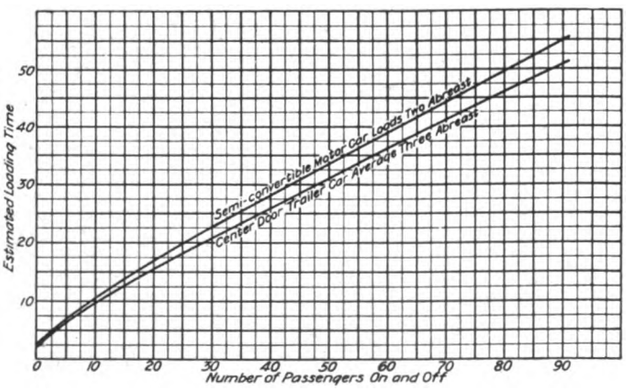
Estimated Loading Time
Number of Passengers On and Off
Semi-Convertible Motor Car Loads Two Abreast
Center Door Trailer Car Are Loads Three Abreast

Fig. 2.—Estimated Loading Time.

A combined air and electric coupler automatically connects the train coupler by means of contacts in the head of the coupler. The arrangement of these couplers is indicated in Fig. 5. The use of a storage battery and the automatic coupler gives the advantages of continuity of control current independent of the power supply, thereby providing means of reversing the motors in emergency and producing less liability of short circuit and "grounds" as a result of arcing between the points. The P.C.-5 control is itself arranged for automatic acceleration of the train at the predetermined current per motor. This prevents abuse of the equipment, and ensures the most economical operation from the power consumption standpoint. The main control consists of a series-parallel motor controller composed of a line breaker, eight contactors actuated by means of cams attached to a shaft, and a reversing shaft for the motors, called a reverser. The arrangement of cams on the cam shaft is such that the contactors can never be closed except in a definite order. The shaft is driven by means of an air-operated mechanism controlled by two magnet

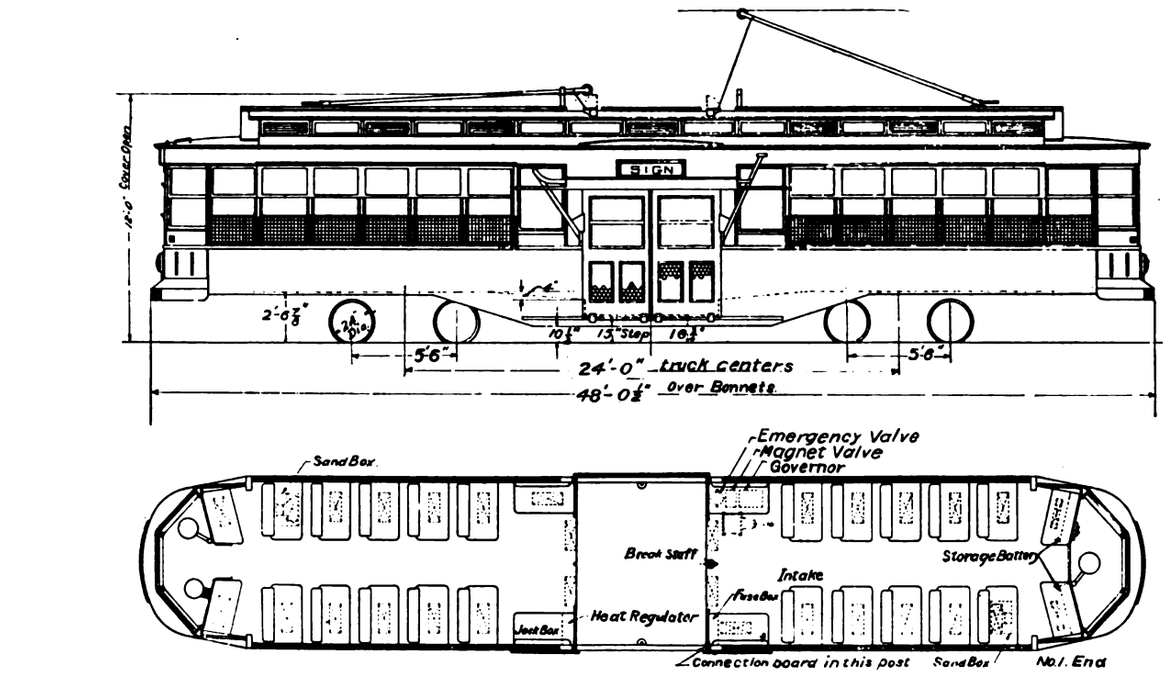

Fig. 1.—Elevation and Plan of New Stepless Low-Wheel Car.

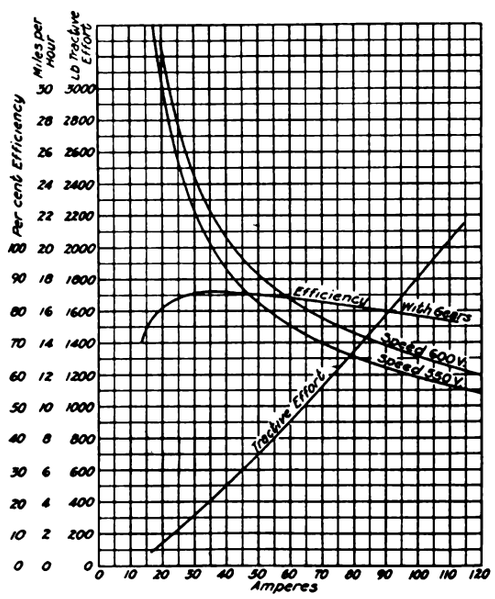

Fig. 3.—Characteristic Curves of GE-247 Railway Motor.

valves. The energising and de-energising of the magnet valves is governed by a current limit relay, thus preventing the operation of the motor controller above a pre-determined current. On the cam shaft is also mounted a control cylinder with segments and

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fingers for making the required control connections for each step, and for ensuring the proper working of the line breaker, reverser, and cam-operated contactors. The line breaker is electrically controlled and pneumatically operated. The reverser is of the cylinder type, and is actuated by air electrically controlled through two magnet valves. The master controller has a separate reverse handle and cylinder, which is mechanically interlocked with the main cylinder, thus ensuring that the reverse handle is thrown for either

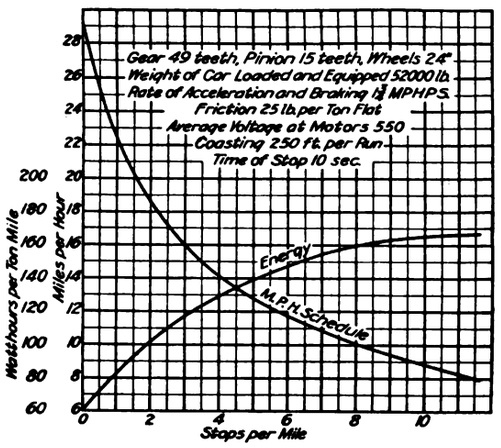
Gear 49 teeth, Pinion 15 teeth, Wheels 24"
Weight of Car Loaded and Equipped 52000 lb.
Rate of Acceleration and Braking 2½ MPHPS.
Friction 25 lb. per Ton Flat
Average Voltage at Motors 550
Coasting 250 ft. per Run
Time of Stop 10 sec.
Watthours per Ton Mile
Miles per Hour
Energy
M.P.H. Schedule
Stops per Mile

Fig. 4.—Schedule of New Boston Car.

the forward or reverse direction before the main cylinder is turned on. In addition to the fingers required for controlling the position of the reverser, the reverse cylinder of the master controller has twelve additional segments and fingers which provide for the electrical and mechanical interlocking of the head and tail lights, emergency lighting, and signal buzzer. It is only necessary for the motorman to place the reverse lever of the master controller in the proper position, and all circuits are automatically connected, whether the cars are being run singly or in trains.

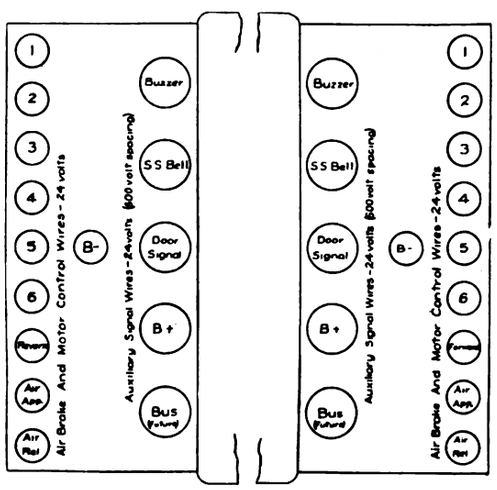

Fig. 5.—Arrangement of Coupler Contacts.

The main cylinder has three positions—first, switching point series; second, accelerating point; and third, accelerating point parallel. In order to provide for unusual conditions in which an accelerating current greater than the pre-determined value is required, the master controller is provided with a small switch operated by a lever on the controller cap plate. When this switch is closed the train wire is energised and by-passes the current limit, the relay permitting the master controller to advance one step. By repeating the operation of closing and opening the by-pass switch the motor controller will advance to the running position indicated by the master controller, and gives an acceleration similar to a non-automatic control.

The main handle of the master controller is provided with a dead-man's release, which cuts off the control current from the motor whenever the motorman releases the controller handle. To guard against possible emergency conditions whereby the motorman might lose control of the train due to some other master controller than the one he is operating having been accidentally brought into circuit, a push-button switch is placed in the side of the master controller, which, when closed, short-circuits all storage batteries, thus cutting off power from the motor controller on all cars of the train. The short circuit switch cannot be closed, however, until the reverse lever of the master controller is moved to the reverse position, as it is intended that the motorman should first attempt to reverse the direction of the current through the motor field before short-circuiting the storage batteries.

When the master controller is turned on, the reversers in the train are first thrown for the corresponding car movement, and the control circuit is next established

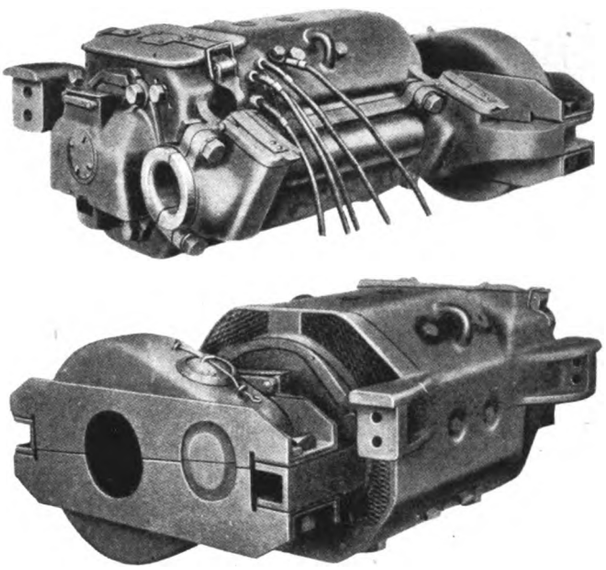

Fig. 6.—The GE-247 Railway Motor.

through the magnet valve and the line breaker. To ensure proper sequence of operation, the reversers must throw to the proper position and the line breaker must close before the series contactors can close and complete the motor circuit. The further progress of closing contactors is governed by the current limit relay, and is controlled through the master controller. Overload upon the motors causes the overload trip operation to open the control circuits for the magnet valve coils returning the line breaker and contactors to the open position.

A smaller enclosed switch and fuse having three positions—" off," " on," and " re-set," is provided in the control circuit for each master controller. When thrown to the " on " position, the moving arm is held latched in contact with the clip carrying current to the master controller. When thrown to the " re-set " position, a set coil on the overload relay is energised and the relay contactors closed. The moving arm is returned to the " off " position by means of a spring as soon as the handle is released. The construction of the switch makes it impossible to reset the overload relay without first opening the control circuit for the motor controller. Each car is equipped with a 40

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ampere-hour storage battery which supplies power for working the control and auxiliary electrical apparatus. The battery consists of twelve lead plate cells, each providing a maximum of 32 volts and an average working potential of 24 volts. All batteries throughout the trains are connected by bus wires. The batteries are automatically charged by means of a relay and adjustable resistance in circuit with the compressor motor, the resistance being so adjusted as to divert the proper charging current to the battery.

For lighting the cars in normal conditions there are five circuits of five 23-watt 115-volt lamps. Whenever the main power supply is interrupted, five 30-volt lamps operated from the storage battery are automatically brought into circuit. A lamp in the rear cab serves to illuminate both the vestibule and the red-coloured lens in the tail light. By placing the reverse lever of the master controller in the forward position the head light on the front end and the tail light at the rear of any car or train are brought into circuit. If the control circuit is interrupted, the emergency lighting circuit is closed, and the two lamps illuminate the red lenses of the tail lamps at both ends of the car or train.

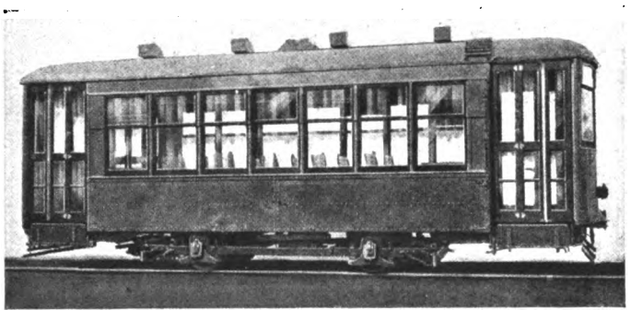
An electric heating system is provided, and the circuits are automatically controlled through a thermostat so that a uniform temperature is maintained.

In place of the bell the motorman receives his signal to start from a small lamp so interlocked through contactors at each door that it is lighted when all doors are closed. Thirty push-buttons are conveniently placed throughout the car, so that passengers may signal the motorman to stop. These buttons operate a buzzer in the motorman's cab, and another at the conductor's position.

A SMALL STEEL CAR FOR LIGHT TRAFFIC.

Seven 18 ft. 3½ in. closed cars, with a car-body weight of only 6,800 pounds, have been recently completed by the J. G. Brill Company for the Beaumont Traction Company, Beaumont, Texas, which has a population of about 25,000, and is situated in the south-eastern part of the State. It ranks tenth among the cities of Texas. The principal industries are petroleum production and refining, lumber and iron works.

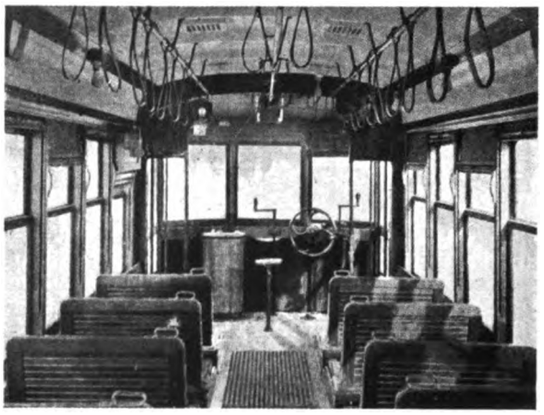
These cars are very similar to others built for the same company in 1915. They are mounted on Brill



A Small Steel Car for Light Traffic.

light-weight 21-E trucks, which have been winning much favour for themselves among American electric railways. The light-weight 21-E truck has 24 in. wheels. The cars are almost entirely of steel, whereas the older equipment of the company consisted mostly of wooden cars. This steel construction has made possible the construction of a car that will stand up under the hardest kind of service, and at the same time will entail a saving in power, maintenance, etc.

The introduction of the Brill light-weight 21-E could not have come at a more opportune time, in view of the tremendous demand for light weight, economical, power-saving equipment which has been experienced throughout the American electric railway field for some little time. The introduction of this truck was an important step in car design improvement, the saving in weight effected by it over the regular Brill 21-E truck being not much less than 1,800 pounds. The light-weight 21-E will carry a car whose weight when empty is 8,640 pounds, and carry a passenger load of 9,000 pounds. Complete it weighs only 3,800 pounds.



Interior of Small Steel Car.

Standard construction for this new truck calls for the use of 24-in. wheels, which of themselves make a very considerable reduction in the total weight. The wheel base is 8 ft., and the use of the small wheels allows this wheel base to be made 6 in. longer than would be the case were 33-in. wheels used. The brake rigging, which is arranged inside the wheels, effects another considerable decrease in the weight.

The construction of the new truck follows almost exactly the design of the regular 21-E, the chief reduction in weight being effected by the reduction of the size of the axles, the lighter brake rigging, lighter wheels, lighter springs, and the use of a lighter side-bar.

In the underframes upon which these cars are built side sills are of 2½ in. by 2½ in. angle extending the full length of the car in one continuous piece. The cross sills are of 3 in. 4 lb. channel fastened to the side sills and the truck sills (2½ by 4 in. angle) with gusset plates. At the corner post the cross sills are reinforced to carry the platform knees, which are of 6 in. 8 lb. channel set in about 5 in. from the side sill angle. The dasher angles measure 1½ by 1½ in., and are bolted to the platform knees. The platform is braced with a 1½ in. by 1½ in. angle cross member and with 3 in. 4 lb. channel diagonal sills.

FEWER STREET ACCIDENTS IN 1916.

According to a return for the year 1916, issued by the Home Office, there were 2,837 fatal accidents due to street vehicles of various kinds in the United Kingdom, and 51,441 cases of injury. These figures compare respectively with 3,014 and 63,203 in the previous twelve months. The figure relating to non-fatal accidents shows a diminution of over 20 per cent.

In London there were 845 persons killed and 21,928 injured in the streets. To omnibuses were attributed the largest number of deaths traceable to any one class of vehicle, i.e., 198, but their total of injuries is the lowest, being 2,548. Horse-drawn vehicles caused 145 deaths and 4,341 injuries, tramcars 88 and 3,940, cycles 26 and 3,476, whilst "other vehicles" were the cause of 388 cases of death and 8,556 of injury.

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STANDARDISATION.

ITS PROGRESS IN RAILWAY AND TRAMWAY MATERIALS.

Sir John Wolfe Barry, chairman of the Engineering Standards Committee, delivered the James Forrest lecture before the Institution of Civil Engineers on May 21, taking for his subject "The Standardisation of Engineering Materials and Its Influence on the Prosperity of the Country."

The lecturer referred to the formation of the Bureau of Standards of America in 1901 and to partial attention given to standardisation in France as early as 1891. In the United Kingdom, however, the matter slumbered until 1901, when he brought it before the Council of the Institution of Civil Engineers, and the Engineering Standards Committee was formed. It is now composed of 19 representatives of the Institutions of Civil Engineers, Mechanical Engineers, Naval Architects, and Electrical Engineers, and of the Iron and Steel Institute, together with three members elected because of their eminence. It was shown, said Sir John, that many engineers designed work with special, though unnecessary, rolled sections, that consequently purposely made rolls had often to be cut for small quantities of steel in order to meet these demands, causing unnecessary cost and delay, that each manufacture had its own sheet of sections without any community with other rolling mills, and that manufacturers could not with prudence roll for stock, as there was no certainty that their product would be wanted.

The same was true of tramway and railway rails, for everyone designed his own type for the same or similar duties, and each type had some quite unimportant difference of shape. Thus there were 70 different sections of tramway rails, and now the work of the country is better done by five sections of standard shapes. In the case of railway rails almost every railway company had its own section for each description and weight of rails used on its system. Now there are only nine standard sections of bull head railway rails in use on our railways, from a weight of 60 lb. per yard, increasing by 5 lb. per yard up to 100 lb. per yard. There are 17 standard sections of flat bottom rails ranging from 20 lb. to 100 lb. per yard, which are very largely, though not exclusively, used in export trade.

The first publication—viz., the "Lists of British Standard Sections"—was issued in 1903, and further specifications to the number of 77 have year by year been added up to the present year, while several others are under consideration. Revisions of publications in order to follow advances in the subjects dealt with have been from time to time undertaken.

The National Physical Laboratory acts as the committee's official testing bureau, and, generally speaking, is the ultimate scientific authority in matters concerning mechanical, metallurgical, and electrical tests.

Soon after the first sectional committee was formed for dealing with rolled sections, demands arose in connection with other subjects, and three other sectional committees were nominated for introducing standards in other important manufactures.

Thus the project of standardisation became launched in 1901-2 by the nomination of four sectional committees:—(1) On bridges and building construction, (2) on materials for shipbuilding, (3) on locomotives and railway rolling stock, and (4) on railway and tramway rails.

The total expenditure of the committee since its formation in 1901 to March 31, 1916, has been approximately £51,000, an average of about £3,400 per annum—not a large sum in view of the work accomplished, and contrasting somewhat strangely with the very liberal contributions to the Bureau of Standards in the United States.

The contributions towards the expenses received since the inception of the work in 1901 may be divided as follow:—From His Majesty's Treasury, £10,397, or an average of about £694 per annum. From the Indian Government, £1,800, or an average of about £120 per annum. From the engineering profession and industry by direct contributions, neglecting the very large amount of time and money devoted gratuitously by members of the committee to the work, £20,000, or an average of about £1,334 per annum.

The Indian Government has made various grants towards the general expenses of the committee in recognition of work done in the interests of that country, and especially in regard to the first report on the standardisation of Indian locomotives which received the approval of the Secretary of State for India in December, 1904, and the Governments of New South Wales, Queensland, South Australia, and Victoria have recently become subscribers to the committee's funds.

Among the four sectional committees first formed in 1901 was one for arriving at standards for locomotives. It is much to be regretted that, as far as locomotives for service in this country are concerned, very little has been effected. In India it has been otherwise.

In the matter of rolled sections for construction and shipbuilding, the total annual output in a pre-war year was about 2,400,000 tons, worth probably about £17,500,000. Of this quantity at least 85 per cent. was rolled to standard sections and specifications, and in some cases the proportion rises to 95 per cent. upwards.

Of rails for railways and tramways amounting to 991,000 tons annually, of a value of about £6,100,000, approximately 75 per cent. of tramway rails were rolled to British standard, and in the case of bull head railway rails, which are almost exclusively used in this country, although it is more difficult to give a definite figure, it is no exaggeration to say that rails now rolled to standard are rapidly approaching a figure of 90 per cent., as practically all the railway companies since the war have agreed to adopt the standard.

It is more difficult to arrive at the proportion of electrical products made in accordance with the British standards, owing largely to the state of flux of the industry due to the rapid advance of knowledge in this science. Most of the telegraph material employed by the British Post Office, the whole of the tramway poles now used throughout the country, and at least 90 per cent. of the cables and wires for electric light, telegraph, and power purposes are made to British standard. According to the last census of production, the cables and wires alone are given at about £4,000,000 per annum.

In 1905 the standard specification, dealing with Indian locomotives, was issued, and by 1908 a thousand engines, had been built or were under construction, and this number has now increased to 2,300 locomotives, representing roughly 7¾ millions of pounds sterling. Ten years of practical experience has shown the advantages of the policy which has been pursued in India both from a public point of view and from that of the trade.

The lecturer referred to developments which were to be instituted by the British Engineering Standards Committee to assist manufacturers in competing successfully in foreign markets, this step being the outcome of a Government Committee on Engineering Industries, which met last summer under the chairmanship of Sir Clarendon Hyde. The committee have accordingly asked for, and have obtained, substantial assistance from the trades concerned, amounting so far to close on £13,000, and His Majesty's Government have made a grant of £10,000 towards the expenses of the new departure. These funds had enabled the translations to be set on foot, and the cost of the publications to be reduced to a flat rate of 1s., following in that respect the example of the United States.

THE KING AT THE WESTINGHOUSE WORKS.

The royal visit to the Manchester district on May 14-15 will be long remembered by the employees of the British Westinghouse Electric and Manufacturing Company, for His Majesty the King took the opportunity of visiting the works at Trafford Park. King George and Queen Mary had become familiar figures in industrial establishments both before and since the war, and it is well known that His Majesty takes a great interest in the work of munition and supply, but we have not yet heard that he has ever before operated the time register on arrival and on departure.

The modern aspect of the buildings may have impressed His Majesty, as it certainly did some of the newspaper representatives who were present, with the fact that industrial work can be conducted in light, healthy, and cheerful surroundings. The great length of the main building with its eight commodious aisles forms a striking spectacle. The buildings occupy 160 acres in Trafford Park, of which approximately 40 acres are roofed in. Building operations were begun early in the year 1901, the manufacture of goods starting early in 1902. The volume of business has steadily increased, and extensions of buildings have been made from time to time, further enlargements being now in progress. The entire works are now busily engaged at highest pressure, the number of employees being over 10,000. In this number are included a large number of women, and it is interesting to know these number approximately 2,500 more than in pre-war times. The women wear neat khaki overalls, usually decorated with military regimental or naval badges, in practically all departments of the works, each "doing their bit" and doing it zealously. A number of special canteens have been provided for their use, and their general welfare is specially cared for by a lady superintendent of women workers.

Over 2,600 men have left the company's employ since the outbreak of war to join the colours, and of these about 200 have given their lives in their country's service.

An interesting innovation started by the Westinghouse Company is a school for the instruction of apprentices. The company accepts two grades of apprentices. One consists of graduates in engineering and other technically trained men, who are allowed to take a two or three years' course of a varied character in the shops, testing departments, and offices; the other consists of boys who enter the works between the ages of 14 and 16, and remain until 21. The whole of the lecturing work is undertaken by members of the company's staff, the lectures numbering about 40 in all. Details of this scheme were explained to His Majesty by Mr. Fleming, who has studied trade education questions very deeply.

The following gentlemen were presented to His Majesty during his visit to the works:—Messrs. Annan Bryce, M.P., W. W. Blunt, Norman B. Dickson, A. Spencer, P. A. Lang, Sir Edward Goulding, M.P., A. E. Scanes, H. Mensforth, M. A. Maclean, J. H. Tearle, P. N. Rand, J. S. Peck, G. Woods, A. Seaman, and F. Rogers.

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THE
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American Electric Railways and the War.

Despite the present slowness of the mails, evidence continues to accumulate of the work done in connection with the war by American electric railway companies. Some of these activities are of much interest, and indicate that electric railwaymen not only intend to do their part in preparation for the great struggle, but to put forth their best efforts to rouse the public, particularly in the west and south, to a realisation of what is required. Some of the electric railway companies are—or were early in May—supplying information to the public in regard to the great war loan, and were receiving subscriptions to it without making any charge for their services. This has proved useful in sparsely populated localities where banking facilities are scarce. The street car advertising contractors have offered to the Secretary to the Treasury free card space to advertise the bonds. In this way passengers will be daily appealed to. A plan which proved useful in this country is also being adopted—namely, companies making advances to their employees wherewith to purchase bonds, the advances to be repaid gradually by deductions from wages. Collectively the electric railways, as represented by the American Electric Railway Association, are doing what they can to forward the interests of the country in the war. The Executive Committee have passed a resolution in which they say that they have pledged to President Wilson their patriotic support to all measures which he may take, that the efforts and energies of all electric railway officers should be devoted to preparation of their systems for the added demands, military and industrial, which may be made upon them, and that the resources of the manufacturer members of the association are liable to call from the Government in the furtherance of its military plans. In view of these things it was resolved that the convention and exhibition of the association in its usual form be abandoned for the year 1917, and that the association accept the trust imposed on the transportation agencies by the President in so far as it applies to electric railways. It is possible that, following the course adopted by the tramway associations in this country, an informal gathering of a business kind may take the place of the usual convention. The abandonment of the ordinary convention appears to meet with general approval among the electric railway fraternity, and it is recognised that all the energies of the companies will be required for carrying goods as well as passengers and for making plans to meet prospective difficulties in operation and maintenance.

The Canadian Electric Railways.

Electric railwaymen in the United States are taking courage in regard to the supply of labour during the war from the experiences of the Canadian lines. It is now nearly three years since Canadian enterprises began to be denuded of labour, owing to the men going off to the war. Canada has raised an army numbering nearly 6 per cent. of the population. Enlistments from her electric railways average 20 per cent. of the total number of employees, but replacement has not been very difficult. In some places one-man cars and in others women conductors have been introduced. Reasoning from this the conclusion is reached that the raising of an army of 2,000,000 men in the United States will cause little trouble in the operation of the

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electric railways. The 2,000,000 men will only be 2 per cent. of the population, and the proportion of electric railwaymen called away will only be about 7 per cent., as against 20 in Canada. All this is, of course, very good for the time being. But the possibility of a still bigger army being required before the war is over should not be lost sight of by the American companies, and they might not unprofitably acquaint themselves with what has been done by tramway undertakings in this country whose staffs have been so excessively depleted by the demands of the war. Finally, the electric railway companies, acting on the alarmist forecasts of Mr. Hoover as to a possible food shortage, are offering for cultivation land which they own, and the offer seems to be meeting with acceptance.

London Tramway Finances.

By slow degrees the London County Council is being brought to regard its tramway undertaking as a business that must pay its way. For many years the Council has dealt with the system as though it were under no obligation to the present generation of ratepayers, and as a consequence the financial position has steadily grown worse. The situation to-day is far more precarious than the results indicate, because for the past few years no provision has been made for depreciation, and before long large sums will be required to bring the track and equipment to proper condition. In 1910, after careful investigation, the Council decided that three-farthings per car-mile was the least charge on the earnings that would meet the cost of maintenance; but as soon as the earnings became insufficient to meet that impost it not only ceased to be charged, but the sum previously accumulated was drawn upon for general purposes. This was a necessity that in the case of reasonably prudent men of business would have led without delay to a closer study of the basis on which fares had been arranged. This task promised, however, to bring little gain in popular favour, and it has been postponed until the tramways are on the verge of a deficit which, if realised, can only be met by a call on ratepayers. Sooner or later a confession of failure would have to be made, and recognising this at length the Council have seized upon the war as an excuse for certain changes in fares. Halfpenny fares are abolished, and ordinary return fares are increased 25 per cent. These changes will improve the position, but they are not likely to be sufficient to meet the needs of the undertaking. The task of making the Council's system a financial success is by no means easy; it is burdened with heavy capital charges due to the original mistake of using the conduit system on many routes where it was not necessary, to capital charges for street widening that ought not to have been allocated to it, and to large maintenance charges for the upkeep of roads worn out by the vehicles of other owners. Yet these conditions were known, and they afford no excuse for the past financial management. Although confronted with them, the Council has never thoroughly grappled with the problem they presented, or the chaotic scheme of fares would long ago have been reconsidered. Year after year a serious loss, estimated at £80,000 per annum, on workmen's fares has been allowed to continue because all parties in the Council wished to avoid responsibility for interference with that traffic. Halfpenny fares, on the scheme adopted, were probably unremunerative; but here again it was pleasanter to shirk the responsibility of a confession of error, and to nourish the hope that rectitude of intention would secure a fortuitous success. The war has finally dashed that hope, and provided an occasion for putting the Council's house in order. Only a beginning has been made, but it may be hoped that the problem will be thoroughly and honestly solved. As respects its tramway undertaking, the Council should have as its essential aim thorough financial stability; it cannot reduce its liabilities, and philanthropic concessions to passengers, however desirable, are unjustifiable until the tramways are placed in such a position that they are self-supporting. With a more definite policy such a position might have been attained long ago. To enable the Council to avoid the accusation of hasty alterations in fares, and to justify any future changes that may become necessary, the Highways Committee would be well advised to resume the regular weekly publication of the traffic returns. This information is due not only to the members of the Council but to their constituents.

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Medical Examination.

Confirmation of the arguments advanced by Alderman Dr. Chapman in his paper on the medical examination of employees at the 1909 Conference of the Municipal Tramways Association is afforded by the three sudden deaths of motormen within the past few months. In particular these sad occurrences bear witness to the necessity for a periodical examination of motormen, as every reader will admit who turns to his file of this journal for October 7 of the year mentioned. Two London drivers died from heart trouble while their cars were in motion; and a Dublin driver engaged in teaching a learner was stricken with apoplexy. One of the London men had a heart twice the normal size, and there was pleuritic adhesion of both lungs. This fatality by itself affords proof of the reasonableness of Dr. Chapman's contention that there should be periodical re-examination of men already in the service. Irrefutable reasons for the latter course were advanced by the author of the paper, and were supported by Sir John Collie from his unique experience as medical examiner to the London County Council and the Water Board. It was insisted by the speakers already named, supported by other experienced managers and administrators, that the public safety demanded the adoption of the main proposals put forward in the paper, viz., an examination before entrance to the service and re-examination every five years. The interval may seem to be an unduly long one, but if such a regulation were enforced in conjunction with Sir John Collie's rule of re-examination of men who remain on the sick list for 28 days, the precaution would seem to be as thorough as can be reasonably expected. It would also meet the contention laid down by the representatives of the Municipal Tramways Association and the Tramways and Light Railways Association, who formed the Brakes Committee appointed by the Board of Trade in 1908. Lest the objection be raised that with the existing dearth of men the tests would handicap the carrying on of passenger services, we would urge that the strain of long hours and bad lighting provides an additional reason why the human element should be as reliable as possible. That was the view taken by the Home Office Departmental Committee, representing all interests, in the report they issued last year on the question of employing as public service drivers men who have lost a limb, or been otherwise injured in the war. From the point of view of the Workmen's Compensation Act it is a matter of self-interest for traction authorities to support that contention. If they fail to do so they run the risk of having to pay exemplary damages for negligence in any action that may arise from a member of the public being injured in an accident resulting from the illness or death of a driver.

SIR ALBERT STANLEY.

Everyone acquainted with the improvement effected in London's means of passenger transportation within the past few years cordially welcomed the appointment of Sir Albert Stanley to be President of the Board of Trade. It was his work as organiser and administrator, first in America, then in connection with London's passenger services, and finally as director of munitions transport to the Ministry of Munitions that led to his being pressed to join the Government. Appointed early in the year, he at once became so much engrossed in his new duties that he was able to attend in the House of Commons but seldom, and it was not till May 17 that he delivered a speech in the historic chamber. The occasion was the presentation of the annual estimates for the Board of Trade, and Sir Albert acquitted himself well. Speaking for about an hour, he passed in review the activities of the Board of Trade in connection with a number of subjects. With no attempt at oratory, he delivered a lucid exposition of practical business matters of great moment. His speech was well arranged, and, though speaking extempore and for the first time in the House of Commons, Sir Albert betrayed no sign of nervousness. He was congratulated on his speech by several experienced Members who followed him.

The fact that the scheme which he explained for the establishment of the British Trade Corporation met with a good deal of pungent criticism did not reflect on his constructive ability. The scheme was really drawn up by Lord Farringdon's expert committee on the subject, and Mr. Runciman, the late President of the Board of Trade, was about to give effect to it when he retired from office. The criticism was directed mainly to details, and while some modifications may possibly be made in the arrangements, the need for such an organisation as that proposed is so claimant that the principle will no doubt be adopted. It has been an immense disadvantage to British enterprise that we have hitherto possessed no organised means of securing the promotion of large enterprises abroad such as have been at the command of German promoters.

TRACTION COMMITTEE FOR NATIONAL SERVICE.

As reported in our issue of May 12, the Ministry of Munitions recently suggested the formation of a committee consisting of representatives of owners and employees of traction undertakings, with a view to arranging for the release of more employees for National Service. This committee, consisting of representatives of the London Omnibus Owners' Federation (H. E. Blain), the Municipal Tramways Association (H. Mozley and A. R. Fearnley), the Tramways and Light Railways Association (E. H. Edwardes and A. H. Pott), the Provincial Omnibus Owners' Association (S. E. Garcke), the Amalgamated Association of Tramway and Vehicle Workers (Charles Watson, John Cliff, and J. E. Corin), and the London and Provincial Union of Licensed Vehicle Workers (R. W. G. Clode, Frank Keates, and A. Smith) has now been appointed. Mr. H. E. Blain is chairman of the committee, the employers' secretary is Mr. A. de Turckheim, and the employees' secretary, Mr. S. Hirst. The joint committee has now issued notices to all concerned, whether as employers or employees, of the new terms upon which substitution volunteers from traction undertakings will be enrolled. The substitution volunteers will have priority of consideration for re-employment by their original firms, and those who volunteer will have the option of refusing any offer made to them if it does not suit their requirements. The National Service pay will not be less than what they have been earning, and if with the employee's own consent he is transferred to another district, he will receive an additional subsistence allowance of 2s. 6d. per day for seven days per week. It is suggested that motormen, omnibus drivers, and skilled mechanics should not in the first instance volunteer under the scheme.

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LONDON HALFPENNY FARES ABOLISHED.

COUNTY COUNCIL ALSO SUSPEND ORDINARY RETURN TICKETS.

At a meeting of the London County Council on May 22 the Highways Committee reported that on February 6 they informed the Council they had appointed a special sub-committee to consider and report what alteration should be made in connection with tramways operation, with particluar reference to services and fares and methods of collection. While the investigations were proceeding they considered it necessary to have the assistance of a special sub-committee presided over by Mr. W. J. Squires. The complete solution of these questions, the Highways Committee stated, will require further consideration before a final report can be presented. The present report deals with matters which, owing to special and urgent considerations, the sub-committee decided to bring to the committee's attention without delay. The financial burdens placed upon the tramways by reason of war conditions are very heavy. On February 20, 1917, the Highways Committee reported that from the outbreak of war to March 31, 1917, expenditure in respect of war bonuses and war wages, increases in rates of pay and war service allowances to dependants, would amount to £431,000. On the basis of the present establishment, and apart from further substantial increases since accrued or in prospect, the annual cost under these three heads alone is £208,400, equivalent to a charge of 1·288d. a car-mile run. Further, the high prices of coal, and of all kinds of materials and goods, have been responsible for heavy additions to the working costs.

THIS YEAR'S ESTIMATED DEFICIT.

The revenue estimates for the financial year, prepared in January and February, 1917, show a deficit of £89,402. The estimates include provision of £40,000 for contingencies; but since the date of the preparation of the estimates, actual and prospective increases in expenditure on wages, coal, etc., make it clear that the contingency provision will be inadequate, and the deficiency greater, unless the results are better than those anticipated. Even on the basis of the present estimates, the deficit of £89,402 would more than exhaust the general reserve. The committee are considering what action should be taken to provide the revenue required to secure financial stability, having regard to the position of the general reserve and renewals funds; but from the considerations above mentioned they say it is evident that steps should be taken to secure an immediate substantial improvement. They have been impressed with the necessity for effecting improvements in connection with fare collection. They are satisfied that such improvements cannot be looked for unless the duties of conductors are simplified, and that the most practical methods are those which will simplify the fare system. They advise the Council as an experiment to suspend halfpenny fare stages and also the issue of ordinary return tickets. The general manager estimates at about £60,000 the increase in yearly revenue as a result of suspension of halfpenny fares; and with regard to suspension of return tickets, he is of opinion that the consequent additional yearly revenue may be about £45,000.

MISSED FARES—THE PRESSURE ON CONDUCTORS.

The tramways undertaking is suffering considerable loss of revenue through non-collection of fares, as under present conditions conductors are unable to perform their duties with the required degree of efficiency. The increasing complexity of these duties, before normal conditions were interrupted, was attributable partly to the speeding up of the services and partly to the growing complexity of the fare system, due to the lengthening of routes (including through running), the institution or extension of transfer tickets, return tickets, and other facilities. Under the abnormal conditions now prevailing the difficulties with regard to fare collection have been considerably increased, owing to the greater average number of passengers carried, overcrowding, and poor lighting for a considerable percentage of running hours. Fifty-four per cent. of conductors are women, most of whom have only recently entered the service. The size of the cars and the conditions under which they are operated make it extremely difficult to deal with halfpenny traffic. The average speed—approximately nine miles an hour—is in excess of that prevailing on any other tramway in this country. Owing to shortage of staff and other causes the Council are unable to maintain in service the number of cars which under normal conditions would be provided. The closing of railway stations in and near London, and the growth of industrial centres in outlying districts, have added to the difficulties, and many services are inadequate. To maintain the services at the highest attainable degree of efficiency under most difficult conditions, it appears to us that the suspension of the minimum (halfpenny) fare stage is necessary.

The general manager has reported, the committee state, that the suspension of the halfpenny stage will immediately relieve difficulties in connection with fare collection. The increase—already great, and still growing—in working costs has to be reckoned with. Halfpenny stages have been discontinued on all the municipal tramways adjacent to London in conjunction with which through running arrangements have been operative; and a decision by the Council on the question of halfpenny fare stages is a matter of urgency in connection with the revision of these arrangements. The suspension of halfpenny fare stages will not affect the arrangements under which children are charged half fares for penny stages.

RETURN TICKET SYSTEM.—WORKMEN'S FARES UNAFFECTED.

During the past few years there has been a considerable increase in the number of return tickets. When the Council took over the North Metropolitan Tramways the return tickets in use were retained. Ordinary return tickets were not issued on the southern routes until 1912. Owing to the greater length of the southern routes, as many as three or four varieties of return tickets—on which there are many transfer stages—are in use on some routes; and the committee are satisfied that the suspension of return tickets will assist in simplifying the work of the conductors. The suspension of the return ticket will deprive the passenger of a concession from which he draws a small monetary benefit.

The suspension of ordinary return tickets will not affect workmen's return tickets. The committee are advised by the sub-committee that they are satisfield that these proposals must be included in any proposals put forward by them for improving tramways operation, having regard to present conditions. The committee are proposing suspension, not abolition, of the fare ratings referred to, as they have no wish to prejudge the question whether there should be a reversion to them on the resumption of normal conditions—including normal working costs. If the Council agrees to the proposals, the necessary arrangements for giving effect thereto will be made within a few days. The committee recommend (a) that halfpenny fare stages on the Council's tramways be suspended, (b) that the issue of ordinary return tickets on the Council's tramways be suspended.

The Finance Committee in setting out the conclusions of the Highways Committee said if the changes are brought into operation on June 1, the estimated additional revenue for the current year will be £87,000. It appears from the Highways Committee's report that the present proposals are to be regarded only as an instalment on account of a comprehensive scheme for placing the undertaking on a sound financial basis.

By 40 votes to 27 the Council rejected a motion by Mr. H. Gordon to refer back the proposal to suspend the halfpenny fare; and the report was adopted.

MANCHESTER CORPORATION TRAMWAYS.

A RECORD INCOME BUT REDUCED GRANT TO RATES.

In his report for the year ended March 31 last, Mr. J. M. McElroy, general manager, Manchester Corporation Tramways, states that in the early stages of the war the revenue was adversely affected, but the improvement that took place last year has been maintained. The year's income is the highest yet recorded. The ordinary working expenses show an increase over the preceding years, mainly owing to increased wages and the greatly enhanced cost of materials. There was also an increase in traffic expenses, due largely to increased cost of uniforms, and further increases were reported under the heads of repairs and maintenance and power expenses. The large payments in respect of war allowances and bonuses were a very serious drain. The department has only been able to meet the payments in respect of war allowances by transferring less sums each year to the reserve and renewals fund than it should have done had the times been normal. The committee have reduced the contribution to the relief of the rates to £50,000 from £100,000. The following statistics include the last three and the pre-war year of 1913:—

YEAR ENDED MARCH 31.	1917	1916	1915	1913
	£	£	£	£
Traffic revenue	965,829	925,301	887,762	876,022
Miscellaneous	9,809	9,680	9,687	8,055
Motor omnibuses	158	1,083	786	—
Parcels	2,881	3,405	3,639	3,568
Total	978,677	939,469	901,875	887,646
Traffic expenses	275,282	261,689	273,002	255,603
General expenses	89,823	88,052	85,809	83,574
Repairs and maintenance ...	96,114	81,755	85,280	84,878
Power expenses...	137,523	129,941	128,350	133,681
War service allowances ...	91,023	92,808	31,763	—
Balance to net revenue ...	288,910	285,222	297,670	329,909
Car miles run	18,388,302	18,486,440	19,155,051	18,768,259
Revenue per car mile ...	12·608d.	12·197d.	11·3d.	11·202d.
Passengers carried	219,097,258	209,877,667	202,768,420	187,675,183

The earnings per car-mile in the past year were 12·773d., a much higher figure than in any previous year. The number of passengers carried showed a considerable increase, though the car mileage was less. The working expenses amounted to 7·814d., an increase of ·525d. The increase was mainly attributable to advances in wages to workmen and to increased cost of materials. The average consumption of energy per car mile was 1·56 units, and the price paid per unit to the Manchester Electricity Department was 1·14833d., as compared with 1·0825d. in the preceding year. The motor omnibus business shows a profit of £158, after providing for depreciation. The average revenue per omnibus mile was 9·677d. and the average working expenses 8·044d.

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PART OF THE LONDON UNITED TRAMWAYS TO BE PURCHASED BY THE L.C.C.

5½ Miles of Hammersmith Lines and Chiswick Power Station Affected.

Since the Highways Committee of the London County Council reported on July 22, 1913, the result of the arbitration with regard to the purchase of the portion in London of the undertaking of the London United Tramways, Limited, they have been in negotiation with the company with reference to a number of outstanding questions. As the result of these negotiations, terms have been agreed which will, in the opinion of the committee, provide for a satisfactory settlement both as regards the purchase and the working of the tramways. The lines affected are situated in the Metropolitan Borough of Hammersmith, are about 5½ route miles in length, and are worked on the overhead system. They include the London termini at Hammersmith Broadway and at Shepherd's Bush Green of the system of tramways worked by the company which extends to Hampton Court, Hounslow, and other points in the county of Middlesex. The arrangements include provision for inter-running arrangements.

It is proposed, without affecting the statutory notice given by the Council under section 43 of the Tramways Act, 1870, that the Council should pay £235,000 and in addition £12,000 towards the company's costs of the arbitration and subsequent proceedings. At the hearing of the case before the arbitrator, certain points of law arose as to which there was a difference of opinion between the parties, and several items in the award were stated in the form of a special case to be decided in the High Court. The total amount that the Council might have to pay under the award if it failed on all points was £264,559. For £235,000 the company has agreed to hand over to the Council the whole of the plant and machinery at the Chiswick power house and depot. The purchase will not be completed nor the purchase money paid until after the war, but the completion is not to be delayed beyond 12 months after the declaration of peace. In the meantime the tramways will continue to be worked by the company

After transfer the lines will be worked by the Council or by the company if so desired by the Council; in the latter event the company will hand over to the Council the gross receipts earned, less agreed working expenses and an allowance for the company's establishment charges. The Council is to be entitled to run cars to any point on the tramways operated by the company in Middlesex, and the company to run cars over the tramways to be purchased. The authority owning the lines in each area is to be entitled to the gross receipts attributable to its area. Questions relating to the adequacy of car services are to be agreed by the managers of the two undertakings, and failing agreement to be settled by an arbitrator to be appointed by the Board of Trade.

The company will for a period of 21 years supply free of cost to the Council the power required for running the cars on the purchased tramways, up to but not exceeding 1,800,000 units a year.

Although Chiswick power station and plant will be transferred to the Council, the company is to be allowed forthwith to convert a portion of the station into a sub-station, and to utilise for at least 21 years in connection therewith some of the plant at the power station. The plant not thus utilised by the company may be sold by the Council from time to time, and the proceeds are to be handed over to the company, if it so desires, and will be regarded as payment on account of the purchase price.

The Council is to have perpetual free access over the company's lines to Chiswick depot. The use of this car shed will obviate the immediate necessity for a further extension of the Council's Hammersmith car shed. The company will be allowed to use a portion of the depot now utilised for a special purpose in connection with the war, for a period not exceeding six months after the declaration of peace.

The Finance Committee in their report approving the proposals, state that the capital expenditure is as follows:—

Purchase price	£235,000
Company's costs to be paid by the Council	12,000
*Council's costs	10,000
*Reconstruction of part of the purchasable lines	63,899
	£320,899

* The expenditure under the last two heads has already been incurred.

In addition, further expenditure of some thousands of pounds will be necessary for junction lines, etc., necessary to give effect to the proposed through running arrangements. The cost of these improvements will, it is expected, be met by the increased traffic due to through running arrangements. It is estimated that, on the basis of an annual mileage of 1,200,000, the balance of receipts over working expenses (including renewals, but excluding power, which will be supplied by the company free of cost) will amount to £22,917 a year.

The debt charges on the capital expenditure set out above would amount to about £26,870 in the first year, decreasing annually by about £545. These figures have been calculated on the basis of repayment being spread over 50 years as regards expenditure on land, and 25 years as regards other items. Including interest at 5½ per cent. on expenditure not yet incurred, the estimated financial results for the first year show an adverse balance of £3,950.

The proposals were adopted by the Council on May 15.

TRAMWAY NEEDS OF COVENTRY.

Power Given to Prepare a Scheme of Extension.

Whilst it is impossible to carry out public works during the world-wide upheaval, the wisdom of preparing the plans for execution after the war is undoubted. In view of the lack of employment possibly then to be looked for, it is important that every community should early arrive at a knowledge of what public work will be urgently needed. Among such requirements tramway construction and renewals will largely figure, accompanied in some cases by street widenings, and, in several towns, the opening up of new thoroughfares.

Laid out in narrow thoroughfares Coventry is a city with a traffic problem, and the great activity engendered by the war has served to accentuate the demand for remedial measures. Concurrently the question of greatly extended tramway services requires to be dealt with. The Coventry undertaking until a few years ago was in the hands of a private company, who were not permitted to carry out much-required extensions. The demand upon the capacity of the lines is now greater than ever it has been, for compared with the corresponding period of last year the number of passengers for any week in May of this year shows an increase of over 39,000 on a total of 284,000, and in receipts of £200 on a total of £1,242. The aggregate figures afford testimony that for a city the size of Coventry the tramways are far from fully developed. Since the undertaking became the property of the Corporation the pressing character of the problem has secured for it more earnest recognition on the part of the municipality, but with the prolongation of the war there has been a danger of allowing it to recede from attention. Discussion on the matter had progressed so far that some years ago the City Council were asked "to consider the question of proceeding with the promotion in Parliament of the proposed Bill in reference to street schemes and other matters." On each annual occasion that it has come forward during the war the matter has been postponed until such time as the national situation permitted of proceeding with so extensive and costly a scheme.

Thanks to the wisdom of Councillor H. W. Wale, chairman of the Tramways Committee, a different result as regards the tramway portion of the project was arrived at when it came before the Council this year. Mr. Wale pointed out that great harm would be done by inactivity as regards the planning of the new tramways. Consequently the Corporation, while allowing the main question to be deferred for another year, gave liberty to the Tramways Committee to submit a recommendation for a Bill or any other proposal.

The position of affairs and the urgency of the tramway side of the subject are best shown by giving a report of Councillor Wale's remarks. He asked the Council to pay regard to considerations affecting the tramways before passing the usual resolution to defer the proposed Bill. He assumed that no one was satisfied with the tramway service. To the "Hear, hear" with which this sentence was greeted, the speaker replied that he was glad to have unanimous approval of that statement, and he added that that approval was shared beyond the walls of that chamber. Improvement was necessary, and undoubtedly the Tramways Committee would have to go to Parliament for powers. If this resolution were passed it would mean that the committee would have to hold their hands for some years after the war before they could give something like an adequate service. If this resolution were carried the whole scheme would be put back to 1921 owing to the delays in Parliamentary procedure, etc. A year's postponement now would mean that so far as the Tramways Committee were concerned the transport and traffic facilities would have to be hung up for at least five years.

Councillor Wale added that the committee's new scheme was bound up with new streets, and it was impossible to separate the two things. Even if the Council had the necessary powers now he did not think they would see the completion of the scheme for seven or even ten years. When the proposals were brought forward, the Council would not be able to say that they were not comprehensive. There was nothing to prevent the Council proceeding with obtaining Parliamentary powers. It could be clearly stated that they did not propose to raise the loan until after the war. In connection with the Government's inquiry as to work requiring to be done after the war, the Tramways Committee had submitted estimates to the Board of Trade showing that the amount to be spent at the end of the war would be something like £350,000. They could not expend one-third of that without Parliamentary powers. It seemed to him wise for the Council to consider the advisability of proceeding with the Bill as early as possible.

In an effort to deal promptly with the needs of growing localities, the Tramways Committee early in 1914 instituted a motor omnibus service, but since the impressment of the six vehicles this great addition to the convenience of the citizens has had to be sacrificed to the national needs until after the war.

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"BARRETT" EMERGENCY CAR JACKS.

An important phase of the "Safety First" movement unquestionably concerns the efficiency of the equipment available in cases of emergency. Prompt action frequently saves life, and the speedy removal of the cause of obstruction on tramways prevents congestion, and thereby conduces to the safe working of the system.

Regarded from the financial aspect, it is obvious that a derailment at a busy junction during the "rush" hours can easily prove to be a most costly accident unless reliable appliances are at hand with which to quickly replace the car on the track. For these reasons we have consistently advocated the more general use of

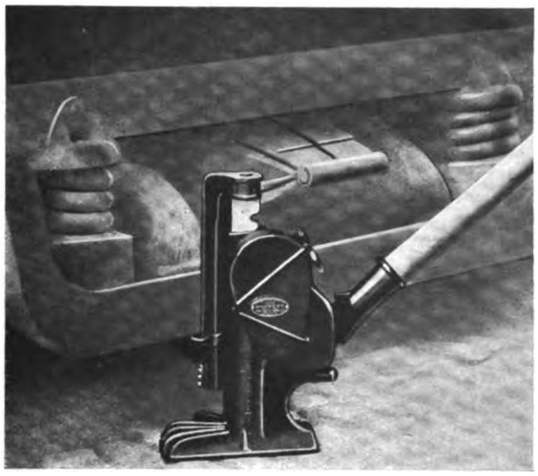

Fig. 1.—Replacing a Derailed Bogie.

car jacks of suitable design, and it is known and recognised that their presence in a single accident has saved the cost of the entire jack equipment of a system.

The accompanying illustrations present two types of the "Barrett" emergency car jacks, which have been specially designed to meet the requirements of electric traction. They are made by the Duff Manufacturing Company, and are supplied by White Motors and Accessories, Limited, of Concanon Road, Brixton, S.W., who are the sole British agents. Fig. 1 shows the 15-ton single-acting type in position after having replaced the bogie of a car on the rail. The special feature of this type is the fact that the

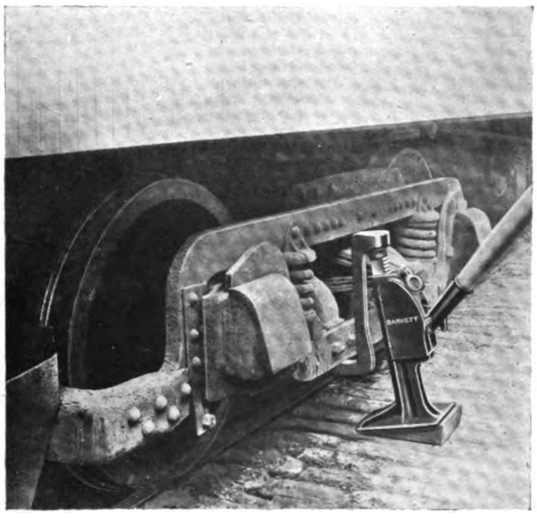

Fig. 2.—View of the Sliding Toe.

swivelling drop-forged steel claw has the full rated lifting capacity of 15 tons in any position, and is the most powerful emergency car jack yet constructed. The claw swings sideways 120 deg., thus facilitating the placing of the jack in close quarters, so that the best clearance can be obtained for the operation of the lever. It can be placed vertically or inclined up to an angle of 15 deg. By reason of the free movement of the claw away from the frame of the jack, a derailed car can be quickly lifted and moved horizontally to the track. The total height of the jack when lowered is 22 in., and of the toe or claw 3 in., with a lift of 10½ in. Each part of the jack is constructed of specially determined material in order to give the maximum strength with the minimum weight. The important working parts are of drop-forged and the main lifting parts are made of chrome nickel-steel, subjected to special heat treatment. The complete jack weighs only 97 lbs. Figs. 2 and 3 show the "Barrett" geared emergency car jack. Great ease of operation is secured in this model by the use of machine-cut reducing gears. A notable feature is the sliding toe hung on the swivel top. This can be quickly adjusted by hand to any height on the rack, from 5½ in. up to 13½ in., thus saving time in applying the jack under low set loads and reserving the entire raise for the actual lift. All the gears, as well as the rack, are accurately machine-cut from the solid bar, heat treated, and case hardened. The socket lever is of the new simplified type, eliminating all small parts, such as rivets, side plates, and fulcrum pin, the place of the latter being taken by trunnions. The capacity of this model is 20 tons on the top and 8 tons on the toe; the overall height is 17 in., with

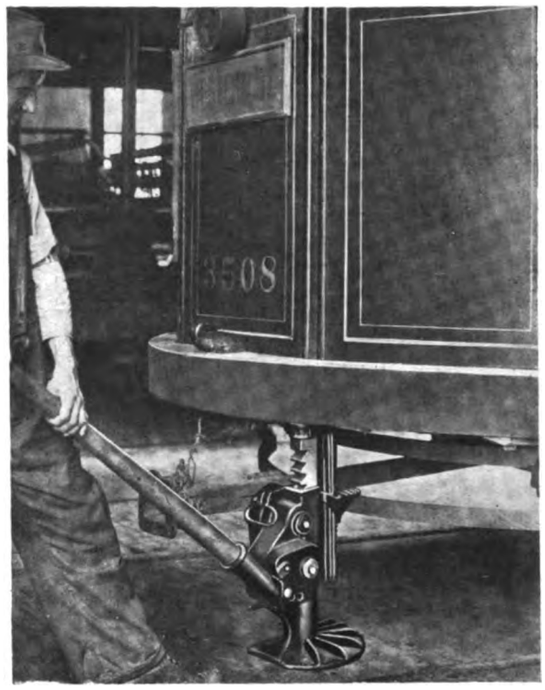

Fig. 3.—Lifting or Lowering Notch by Notch.

a lift of 10 in. In both these models the automatic lowering system is adopted, the load being raised or lowered notch by notch, the direction being reversed by half a turn of the small eccentric at the side of the frame.

OPERATING EFFICIENCY.

CLOSING MEETING OF THE LONDON TRAFFIC GROUP'S SESSION.

A paper entitled "A Review of the Bases of Remuneration to Workers" was read by Mr. G. P. Barnett, assistant to the operating manager of the London Underground Railways and General Omnibus Company, at the closing meeting of the second session of the efficiency meetings of the Operating Department. Mr. H. E. Blain the operating manager, presided over an attendance of over 100 of the senior members of the administrative and control staffs.

Mr. Barnett outlined the bases under which the payment of wages is made, describing the differences between daywork, or payment for the time a man spends on his work, and piecework, or payment for the amount of work done. Details were given regarding the extent to which profit-sharing has been adopted abroad and at home, the class of undertaking embracing this, and the variations in the methods adopted. The past and present bases of paying wages adopted by omnibus companies were dealt with, the change from the daily rate to a journey rate, and from that system to the present mileage basis, the reason for these changes being explained. Then followed a description of the types of bonus payments made to omnibus drivers and conductors who keep free from accidents, and of the various additional payments made to the same grades, such as the minimum daily wage, the minimum weekly wage, the allowance for excessive spread-over, and the payment for overtime. The paper also gave a description of the past and present bases of payment adopted by railways, including the underground companies.

The discussion was opened by Mr. C. Russell (superintendent of the line's office, Underground Railways).

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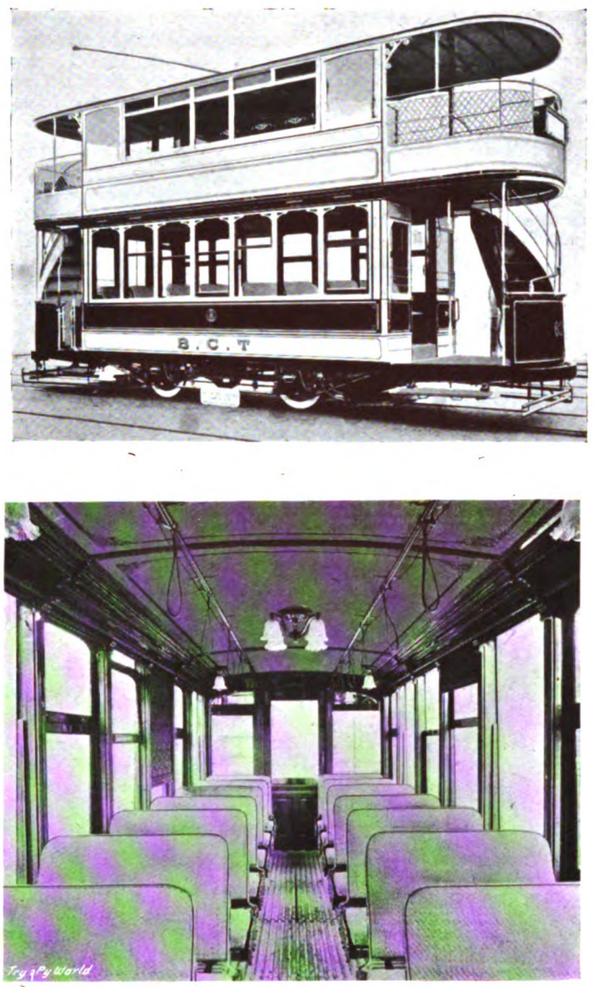
A BLACKPOOL CAR WITH FRONT EXIT.

A correspondent draws attention to some features in common between the new type of Southampton car which was described in our issue of May 10 and a car which was supplied several years ago by the United Electric Car Company, Preston, to Blackpool Corporation. This vehicle, which was described and illustrated in our issue of May 4, 1911, has cross seats on both decks, and they



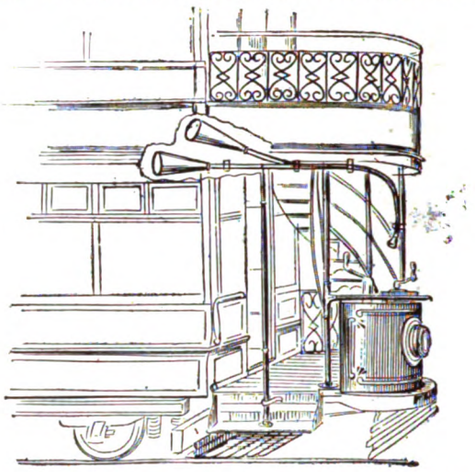
Exterior and Interior of Blackpool Corporation Car with Front Exit and Cross Seats.

are of the rattan spring reversible type. Every seat, however, accommodates two people, ample room being given as the car is no less than 7 ft. 6 in. wide over corner pillars. This car also has the reverse staircase and the extra exit on the near side of the front platform. The upper deck windows operate on the lazytongs principle.

Birmingham Trailer Experiments.—In a report presented to the City Council on June 5, the Birmingham Tramways Committee stated that in order to obtain accurate information as to the value of trailer cars in Birmingham, it will be necessary fully to equip one of the routes with them. Owing to materials and equipments, it has so far been impossible to make much progress in this direction. A trailer car is being run on some of the routes, and the committee will proceed with further experiments as soon as circumstances permit. Councillor Barrow, in moving the adoption of the report, said it was almost impossible on the narrow gauge to have double deck trailers. Single-deck cars, they believe, would be of great benefit to the economics of the department. Such cars would not cause so much wear and tear of the rails and expenditure on the permanent way. Again, the cars themselves would not require so much repairing. The department were much handicapped by the narrow gauge of 3 ft. 6 in., and that caused extra expenditure in different ways. To alter the gauge would be a stupendous operation, and was rendered more difficult by the fact that the narrow gauge applied to the Black Country, whose cars would be unable to run into Birmingham. The committee felt that the right method was to adopt single-deck cars with trailers. The report was adopted.

A MEGAPHONE FOR TRAMCARS.

The accompanying illustration shows a patent megaphone for tramcars which is being manufactured by Messrs. Gabriel and Company, Birmingham. It consists in the first place of a flexible metallic tube, with a mouthpiece at one end, which is fixed in a convenient place for the motorman. The other end of the tube is attached to a brass tube under the canopy. This brass tube is divided by a forked socket, the one fork being carried to the inside of the car

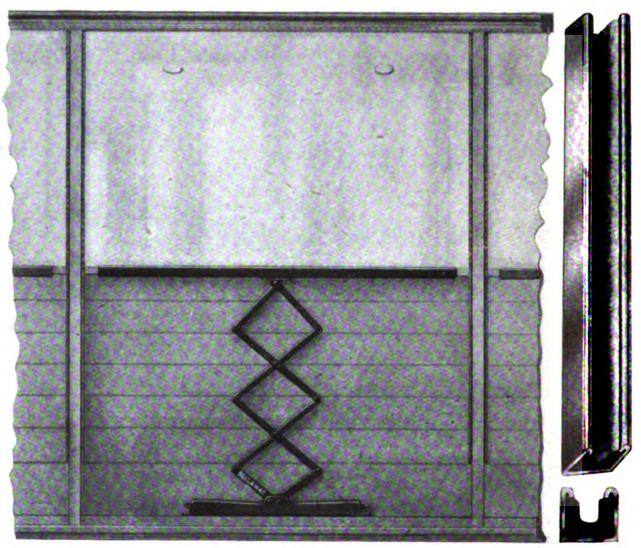


and the other to the top deck. The megaphones to which the tubes are attached are oval, and made in tin, and fixed, the one inside the car and the other under the seat on the top deck.

This arrangement is used by the motorman, who calls out the next stopping-place before the arrival of the car at the various destinations. The megaphone is fitted to the cars of the Liverpool Overhead Railway ; it has given every satisfaction to the company, and is much appreciated by the passengers.

THE NEW SOUTHAMPTON CAR WINDOWS.

In the new car for the Southampton Corporation Tramways, of which details and illustrations were given in our issue of May 10, the windows are mounted on lazytongs balancing gear supplied by Messrs. Beckett, Laycock and Watkinson, Limited, Willesden, London.



The arrangement is shown in the accompanying illustration, one of the main features being that the frameless glass slides in the "Beclawat" silent window channel. These windows have proved so satisfactory that a repeat order has been given.

The Woods-Gilbert Rail Remodelling Machines.—The Ministry of Munitions have granted an "A" priority certificate to the Woods-Gilbert (British) Rail Grinding and Milling Machine Company, Limited, of 170, Strand, London, W.C., for the construction of five machines of their latest type, which was illustrated in our issue of November 9, 1916. It is, of course, impossible at present to obtain new rails, but by means of the Woods-Gilbert machines worn rails can be so remodelled as to give them from five to eight years' additional life.

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REVISION OF FARES AND STAGES.

INCREASED CHARGES TO WORKMEN.

SALFORD CORPORATION TRAMWAYS.—The revised fares, which came into operation on April 2, restore both the fares and the stages to those that were in force prior to the reductions in fares four years ago. The workmen's fares, except on the penny stages, have also been raised, and the concessions to this class are not available after 7 a.m. On April 4 the Corporation agreed to restore the halfpenny fare for children up to twelve years of age.

COVENTRY CORPORATION TRAMWAYS.—The Corporation have applied to the Board of Trade with a view to the maximum cheap fare of ½d. for every mile or fraction of that distance, authorised by Section 17 of the Coventry Tramways Act, 1903, being increased to ¾d. for every mile or fraction of that distance. Councillor H. W. Wale, the chairman of the Tramways Committee, informed the Council that the latest increase given to the staff approximated £2,000, which would be a dead loss. The committee had to consider what could be done to make the undertaking self-supporting, and as the view was taken that everyone was sharing in the general prosperity, they considered it their duty to raise the workmen's fares.

NEWPORT CORPORATION TRAMWAYS.—Newport Council have adopted a recommendation by Mr. N. J. Young, general manager of the tramways, for the introduction of intermediate fares while retaining approximately one penny per mile as the basis of the further revision of fares. The fares were increased in April, 1913, but owing to the war the expenses have materially risen. Although the number of car miles now run show a considerable decrease as compared with pre-war times, the estimated increase in working costs compared with the year ended March, 1914, is approximately £5,500. Whilst the traffic receipts show a gratifying increase, they are not adequate to meet requirements. Halfpenny workmen's tickets have hitherto been issued up to 7.30 a.m. These are to be discontinued, reverting, as in the earlier period of the undertaking, to a fare of one penny for any distance, up to 7.30 a.m., and between 5 and 6.30 p.m. on ordinary weekdays and 12 noon till 2 p.m. on Saturdays.

YORKSHIRE (WOOLLEN DISTRICT) TRAMWAYS COMPANY.—As the result of the intervention of Mr. W. Runciman, M.P. for Dewsbury, the Board of Trade have directed the Yorkshire (Woollen District) Tramways Company to put the halfpenny workmen's fares into operation again. The Parliamentary Committee reported to that effect at a recent meeting of the Council, and also that the company contended that the Board had not the power to determine the question of fares. On this and a previous occasion the Board had merely sent copies of the company's correspondence to the Council without expressing any opinion on the question of fares. The committee therefore approached Mr. Runciman, who took the matter up with the Board on the following day, when he wrote expressing the opinion that the Board were not carrying out their obligations, and asking to whom the inhabitants of Dewsbury were to look for protection if the Board did not protect them. The chairman of the committee now contended that with respect to the stages the system was not fair, and that workpeople were entitled to travel any section of one mile for a halfpenny.

BELFAST CORPORATION TRAMWAYS.—The Tramways and Electricity Committee lately agreed to recommend the City Council to adopt the general manager's proposals for the revision of fares and stages, in order to meet the deficiency of £6,000 on the past year's trading, which produced the highest revenue on record. Owing to the increased cost of working, the city accountant estimates a deficit of £22,000 for the ensuing year. The employees have applied for an increase of 6s. per week in wages, and a concession of 5s. would add £12,000 to the deficit. Mr. J. S. D. Moffet, general manager, submitted a further report adhering to the new fares and stages proposed in his original report and to the abolition of cross-town stages and return tickets and modifications of children's fares, but advising instead of Castle Junction as a base for all stages a central area bounded by the City Hall, Albert Memorial, and North Street. This was his suggested compromise in the matter of cross-town stages. In the matter of workpeople's fares at half the ordinary rates, he proposed to extend the privilege from 7.30 to 8.0 a.m., which would bring in the greater number of women and girl workers. After a two and a half hours' discussion, the Corporation adopted the report. The Lord Mayor said he was sure every member had confidence in Mr. Moffet, the manager, who was an expert, and had given great study to the position of affairs. It would be a great mistake to tamper with his proposals.

SHEFFIELD CORPORATION CARS AND OMNIBUSES.—Only four members of Sheffield Corporation voted against the Tramways Committee's recommendation to increase the fares charged on the motor omnibuses running to places outside the city. One of the objectors urged that it would be unjust to charge people living on the omnibus routes more than those residing on tramway routes, but Alderman W. Fenton, vice-chairman of the committee, replied that the department were paying double the old price of petrol, more in wages, and more in allowances to those who had gone into the army. Since the increased cost there had been a loss of 2¼d. per omnibus mile. On the Heeley route the loss was 2½d., Tinsley route 2⅝d., and Wincobank 4½d. Conditional upon halfpenny fares for adults being abolished on the city cars, the Tramways Committee on May 9 recommended the granting of an advance of 5s. a week to male and 2s. a week to female tramway employees to meet the increased cost of living. The increases involve a total outlay of £18,616. Sir William Clegg, moving the adoption of the report, said that with the exception of Glasgow they gave the longest ride. The ratepayers, however, were entitled to receive a reasonable profit, and although the cars were carrying a much larger number of passengers the results relatively were not much better. Materials had increased in cost very largely, the total war bonus was £32,760, or 20·4 per cent. of the total wages; allowances to dependants were £11,500, or 7·2 per cent. of the wages; and now £18,616 had to be added to the wages. In addition £16,500 extra was being paid for electric energy, making a total increase of £79,416. The estimated profit for 1917-18 was £17,745. As a supporter of the halfpenny fare, he hoped that it would be restored after the war. The report was adopted.

OTHER INCREASES AND REVISIONS.—Augmentation of fares—including workmen's tickets in some cases—or shortening of stages have been made on the following undertakings:—*Municipal*—Birmingham, Leicester, Blackburn, Croydon, West Ham, East Ham, Nottingham, Salford, Stalybridge and District, York, Burnley, Dover, Ipswich, Northampton, Chester, Bexley, Ilford, Accrington, Darwen, Erith, etc. *Company*.—Metropolitan, Rhondda, Mexborough and Swinton, Dudley, Stourbridge and District, etc.

TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION.

PROGRAMME OF THE ANNUAL CONGRESS.

As announced in our issue of May 10, the Council of the Tramways and Light Railways Association have decided to hold their annual congress on Friday, June 29, at the Institution of Civil Engineers, Great George Street, S.W., at 2.30 p.m. The Council recognise that under existing conditions it is unfair to ask any manager or engineer to give up the time required for the preparation of an elaborate paper; but they feel there are so many problems to be discussed that an opportunity should be given to meet and exchange views.

The programme as at present arranged is as follows:—

Paper on "The Manufacture, Life, and Maintenance of Tramcar Tires" (illustrated by diagrams and lantern slides), by Mr. Arthur Norton;

"Standardisation of Conditions of Labour and Rates of Pay," by Mr. E. H. Edwardes, general manager, South Lancashire Tramways Company;

"Fares," by Mr. A. V. Mason, general manager, South Metropolitan Tramways Company.

In order to meet the wishes of members to dine together informally in the evening, the necessary arrangements will be made, but the occasion will be of the simplest character.

MUNICIPAL ELECTRICAL ASSOCIATION.

The twenty-second annual meeting of the Incorporated Municipal Electrical Association will be held on June 21 and 22, at the Institution of Civil Engineers, Great George Street, Westminster, under the presidency of Mr. F. M. Long, city electrical engineer of Norwich. The vice-presidents are Mr. S. J. Watson (Bury) and Mr. F. Ayton (Ipswich). Appended is the programme of the meeting, but it is subject to re-arrangement or revision in detail if necessary:—Thursday, June 21, 10 a.m., presidential address by Mr. F. M. Long, city electrical engineer, Norwich. Paper on "Individual Interests in Municipal Enterprise," by Mr. J. Horace Bowden, borough electrical engineer, Poplar. 2.30 p.m., paper on "Fuel Economy," by Mr. J. A. Robertson, borough electrical engineer, Salford. Friday, June 22, 10 a.m., Council meeting. 10.30 a.m., annual general meeting.

BATTERY VEHICLES IN SHANGHAI.—In the annual report of Mr. T. H. Aldridge, engineer and manager of the Shanghai Municipal Electricity Department, it is stated that during the past year electric road vehicles were introduced. The department purchased three Milburn light cars and one Waverley, also a 2-ton General Vehicle Company and a 700-lb. Milburn truck. These have all proved so satisfactory that two more trucks (two tons and one ton) have been ordered from the General Vehicle Company. Monthly records kept of the operating costs of both the cars and the trucks show that the former effect a saving of about 9 per cent. per annum over cheap petrol-driven cars, including capital and running costs, on a basis of 25 miles per day. With a daily mileage of 50 miles, the saving is 30 per cent. In addition to the electric cars used by the department, there were also three privately-owned cars, and several more are on order for private use.

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FINANCIAL REPORTS AND MEETINGS.

Calcutta Tramways Company.—A final dividend is to be paid on the ordinary shares of 6s. 6d. per share, making 9½ per cent. for the year.

Melbourne Electric Supply Company.—An interim dividend at the rate of 10 per cent. per annum, free of income-tax, is payable for the half year ended February 28.

South Wales Electrical Power Distribution Company.—The profits for 1914 were £8,554. The full year's interest of £10,000 will be paid on the old debenture stock, leaving £2,553 to be carried forward.

Colombo Electric Tramways and Lighting Company.—A dividend of 10 per cent. (20s. per share), free of income tax, for the past year is announced, adding £15,000 to the reserve and renewal fund, and carrying forward £8,805.

Wolverhampton District Electric Tramways Company.—The report announces a dividend of 2 per cent. on the ordinary shares for the past year, appropriating £4,000 for renewals, adding £1,000 to the reserve, and carrying forward £772.

Brisbane Electric Tramway Investment Company.—The accounts for the past year show a divisible balance of £101,791. A final dividend of 4s. per share is proposed, making 8 per cent., free of tax, for the 12 months, and carrying forward £23,566.

Callenders' Cable and Construction Company.—Dividends are proposed on the ordinary shares of 10s. per share, a bonus of 5s. and a special bonus of 5s. per share, the same as a year ago, all less tax. £249,207 is carried forward, against £207,347 brought in.

General Electric Company (U.S.A.).—Profits from sales for the past year were $15,294,092, and income from other sources $3,866,881, a total of $19,160,973. Interest on debenture bonds absorbed $571,444, and dividends on stock $8,121,646, while $10,467,882 were added to unappropriated profits.

Canadian General Electric Company.—After writing $408,887 off plant, and setting aside $631,603 for amortisation of munitions equipment, the net profits for 1916 were $1,185,420, and $707,119 was brought forward. $779,843 has been paid in dividends, $500,000 added to the reserve (raising that fund to $3,500,000), and $612,696 carried forward.

Babcock and Wilcox, Limited.—The directors recommend a final dividend of 9 per cent., making 15 per cent. for the year, free of income tax. The net profits were £438,322, and £42,125 was brought forward. The distribution for 1915 was similar to that now announced, while 14 per cent. was paid for 1914 and 16 per cent. for each of the two preceding years.

Southport Tramways Company.—In their report for 1916 the directors state that negotiations for the sale of the undertaking have been reopened with Southport Corporation. The surplus on the year's working showed an increase of £668. The total revenue was £17,699, which is to be appropriated as follows :—Renewals £500, reserve fund £250, carried forward £1,549.

Increased Car Mileage at Southampton.—The Corporation Tramways receipts for the year ended March 31 totalled £86,240, an increase of £8,175 on last year. Passengers numbered 17,718,810 or 2,224,444 more ; car mileage showed an increase of 177,444, and cost of energy was higher by £3,787. The rate of increase in the receipts is being maintained in the current year.

Dominion Companies and Double Income Tax.—In the House of Commons on May 7, the Chancellor of the Exchequer said while the Dominion Prime Ministers were very keen against the double income tax, they had passed a resolution that the subject shall not be taken into consideration until after the war. He could hold out no hope of a reduction in the excess profits duty.

Sheffield Tramways Grants.—Tramway profits to the amount of £367,398 have been used in the relief of rates during the period of municipal ownership. Of this sum £160,548 has been allocated during the past five years. In addition, £20,600 has been given to the University and £12,508 for other purposes. The accumulated surplus funds totalled £25,105 at the end of the last financial year, and the renewals fund £56,576.

Excess Profits Tax Increased.—Introducing the Budget resolutions, Mr. Bonar Law stated that the excess profits duty would be increased from 60 to 80 per cent. No other form of taxation, he said, could be fairer or less detrimental to the national interest than the excess profits tax. The increased duty is to date from January 1, and the munitions levy is to be merged in the excess profits tax and collected by the Board of Inland Revenue.

Buenos Ayres Lacroze Tramways Company.—For the year ended June 30, receipts were $5,883,262, a decrease of $217,389 on the previous year, and working expenses were $3,895,787, an increase of $135,005·76. After payment of debenture interest and amortisation of municipal concessions, etc., there is a balance of $644,519, and $83,638 was the balance brought forward. The directors propose to add 5 per cent. of the divisible balance to the reserve, appropriate 5 per cent. for fees, and ½ per cent. to the Syndic, pay to the shareholders $625,000, and carry forward $35,483.

British Westinghouse Control.—Mr. J. Annan Bryce, M.P., presiding on May 14 at an extraordinary general meeting of the British Westinghouse Electric and Manufacturing Company, said the directors had for some time desired that the control of the company should be transferred to Great Britain. A basis of settlement had been reached in the form of an agreement of option exercisable on or before June 1, to purchase the whole of the American Westinghouse Company's holding in this company. Resolutions were passed authorising an increase of capital to £1,395,000.

Unprofitable Year at Blackburn.—The tramway accounts for the past year show a loss of £2,439, stated to be due to the unavoidable heavy expenditure and the decrease in traffic receipts. The increases are : Cost of current £1,217, income tax on profits £1,758, and grants to dependants of employees on military service £1,217, while the decrease in the receipts is £1,061. Wages and the cost of materials have also increased. It is understood that up to December 31 the accounts showed a considerable profit, but in February last a deficit led the Council to increase the fares. The Tramways Committee have appointed a sub-committee to investigate the reasons for the profit and the subsequent loss.

Warrington Corporation Tramways.—The accounts for the year ended March 31 last show that there was a net profit of £2,050 on the tramways and a loss of £519 on the motor omnibuses. The net profit has been carried to the appropriation account, which now amounts to £6,417, of which £2,000 has been transferred to the relief of rates. The receipts from passengers were £26,143 as compared with £24,412 the previous year. Other receipts totalled £319, making a total income of £26,462. The expenditure was £18,795, as against £16,616 in 1915-16, leaving the gross profit at £7,667. The loan charges, less interest, were £5,617, leaving a net profit of £2,050. The net profit in 1915-16 was £2,620.

Birmingham Tramway Finances for 1916-17.—The Tramways Committee on May 15 received the tramway accounts for the year ended March 31, showing receipts totalling £838,725. The surplus was £76,200, of which £66,205 is to be added to the reserve fund, and £10,085 applied to wiping off expenditure on motor omnibuses. The previous year the surplus was £107,749. The decrease of £31,459 was mainly due to the frequent stoppages of the services occasioned by the failure of the Electric Supply Department to maintain an adequate supply of energy. For 1915-16 £57,749 was added to reserve and £50,000 was contributed in relief of the rates, but this year there is to be no contribution to the rates. The number of passengers was 171,445,020, an increase of 8,186,436 as compared with the preceding year.

Cork Electric Tramways and Lighting Company.—For 1916 the profits were £19,241, and £4,040 was brought forward. The divisible balance was £18,682, out of which the dividends have been paid on the 5 per cent. preference shares, £6,500 added to reserve for depreciation and renewals, £1,534 written off wiring consumers' premises, repair shop equipment, etc., £569 off investments, and £3,915 carried forward. The directors considered it advisable to carry forward an increased sum, in order to provide against still further increase in the price of coal and other materials, and the carrying out of repairs to rolling stock, etc., which could not be executed owing to lack of skilled labour and difficulty in obtaining materials. The 1,250-K.W. Curtis turbine was put into service in September last and has already effected substantial economy in coal consumption.

Rotherham's Record Receipts.—For the year ended March 31 last the tramways undertaking shows increased receipts amounting to £18,286 more than in the previous year, and constituting a record. The total receipts were £70,529, and passengers 16,098,610, or nearly 4½ millions more. The average cost per car mile showed an increase of 1¾d., of which sum 1½d. was due to repairs. £1,075 had been allowed to employees in H.M. Forces. The railless trolley vehicles show a net profit of £768. There is a deficit of £1,013 on these vehicles, a full year's loan charges having now to be met. Allowing for last year's surplus the actual deficit is £418. The net surplus, subject to the allocations required for the reserve funds, is as follows :—Tramways, £12,277 ; trolley vehicles, £768 ; less loss on petrol omnibuses, £1,013 (despite of an increase of £1,407 in receipts); total, £12,032 ; an increase of £1,338. After setting aside £3,500 out of this surplus for excess profits duty, a balance of £8,533 remains. The electricity undertaking earned £49,068, an increase of £15,856. The higher working costs reduced the net surplus from £7,585 to £5,324.

Bath Tramways Company.—Presiding at the annual meeting, Mr. J. Baillie Hamilton regretted the death of Sir James Sivewright, the late chairman, and said that some years ago he was asked to report upon the company, and since that time he had taken a keen interest in the undertaking, having visited Bath and made suggestions which had proved of advantage. The directors had invited him to join the board and become chairman. It was refreshing to find that the cost of tramway travelling in Bath and district had not been disturbed. The company had endeavoured, by exercising the utmost care and economy, to avoid this undesirable change. However, many

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tramway undertakings were seriously considering their position, and it might become necessary to ask the Board of Trade in consideration of the extraordinary state of affairs, to authorise rates of fares in excess of those which the statutory powers allow to be charged. Not only had the fares in Bath not been increased, but it had been possible to grant free riding to over 27,000 wounded soldiers. Notwithstanding many adverse conditions, the traffic and other receipts were up by £1,157, and this is in spite of a reduction in the number of motors. The cost of the maintenance of the rolling stock had been affected by the increase in the price of materials and labour, and this also applied to the permanent way. From personal examination he could say that the maintenance of all assets of the company had been most thorough. The foundry continued to be most useful. The report was adopted. Mr. A. A. Campbell Swinton was re-elected a director.

Brighton Corporation Tramways have had a record year. For the 12 months terminating March 31, 1917, after payment of interest on capital, provision for sinking fund charges and income tax, there is a balance of £7,251, which compares with £2,230 in the previous year and only £18 in 1914-15. The following statistical information shows the relative position for the past four years :—

	1916-17	1915-16	1914-15	1913-14
Revenue	£64,819	£57,974	£56,526	£56,838
Working expenses ...	£37,960	£37,163	£41,148	£42,440
Net revenue ...	£23,321	£16,935	£14,009	£14,398
Interest	£7,345	£7,348	£7,661	£7,897
Sinking fund ...	£6,432	£6,429	£5,917	£5,083
Income tax ...	£1,644	£966	£467	—
Car-miles run ...	1,131,201	1,053,285	1,108,352	1,156,584
No. B.O.T.U. used...	1,837,629	1,678,627	1,676,770	1,722,548
Revenue per mile ...	13·75d.	13·202d.	12·24d.	11·79d.
Expenses per mile	8·05d.	8·47d.	8·91d.	8·80d.
Expenses to receipts	58·56	64·14	72·79	74·66
Per cent. of 1d. fares	77·49	78·43	77·10	76·88
Passengers per mile	12	12	11	10

Mr. William Marsh, tramways engineer and manager, in his report, mentions that it covers the twelfth year since the undertaking attained its present size. He was gratified that the results had been achieved in the face of innumerable difficulties caused by the war and the loss of so many men who had joined the colours. The surplus remaining after defraying the very heavy additional expenditure due to the war amounted to £8,681. The traffic has been greater than in any previous year, the increase in revenue amounting to £6,656.

The Electric Construction Company.—The directors recommend a dividend at the rate of 7½ per cent. per annum on the ordinary shares and 6 per cent. on the preference shares for the year ended March 31, 1917. The general reserve has been increased by the transfer of £12,389, and £31,442 is carried forward, subject to liabilities under the Finance and Munitions of War Acts for two years. During the past year the company has been almost entirely engaged on electrical work. The increased net profit is due to a larger turnover, which is ascribed to the redoubled efforts of the staff and workmen. The appended summary gives a comparison of the results for the past five years :—

	1917	1916	1915	1914	1913
	£	£	£	£	£
Gross profit ...	103,029	88,546	71,999	57,547	62,669
Interest and dividends	2,898	2,802	2,270	1,790	2,045
Transfer and registration fees ...	39	32	22	20	35
	105,966	91,380	74,291	59,357	64,749
Total expenses ...	30,000	29,465	25,299	19,477	23,145
Interest on debentures	6,597	6,647	6,800	5,666	6,903
Depreciation ...	10,000	12,035	6,725	7,084	7,199
Net profit	51,503	43,241	35,567	27,126	27,500
Brought forward ...	16,839	7,471	7,153	6,899	5,694
Less excess profits duty	3,300	—	—	—	—
Balance available ...	65,040	50,712	42,720	34,025	33,194
Dividend on Pref. shares	4,394	4,394	4,394	3,667	4,394
Dividend on Ord. shares	16,815 (7½%)	16,815 (7½%)	13,453 (6%)	11,210 (6%)	11,210 (6%)
To general reserve	12,389	12,664	17,402	12,000	10,691
Carried forward ...	31,442	16,839	7,471	7,153	6,899

CONTRACTS AND ORDERS.

Brown Bayley's Steel Works are supplying steel tires to Glasgow Corporation Tramways.

The British Thomson-Houston Company are supplying a switchboard to Bedford Corporation at £1,650.

John Brown and Company, Limited, have an order from Sheffield Corporation for 500 steel tramway tires.

Hampstead Borough Council have ordered two 1-ton electric vans for disinfection work, at a cost of £1,606.

F. Smith and Company, Limited, of Salford, have received an order for trolley wire from Glasgow Corporation.

Edgar Allen and Company, Limited, have received an order for tramway points from Derby Town Council.

The General Vehicle Company have received an order from Kettering Council for a 3½-ton G.V. tipping wagon.

Glasgow Tramways Committee have placed a contract with W. and T. Avery, Limited, for weighing machines.

Salford Council have given a contract to the New Conveyor Company for 600 steel trays for coal conveyor plant.

Brook and Company have a contract to supply cast-iron brake blocks to the Johannesburg Corporation Tramways.

Plymouth Council have placed a contract with the Brush Company for the supply of eight trucks and car bodies for the tramways.

West Ham Electricity Committee have accepted the tender of Babcock and Wilcox, Limited, for the supply of a marine type boiler.

Leyton Council have accepted the tender of the Premier Bitumen and Asphalte Company, Limited, to supply road material for twelve months.

E. Green and Son, Limited, have an order from Bradford Electricity Committee for an improved fuel economiser, to replace one at Valley Road Works.

J. W. Courtenay, Limited, of Amberley House, Norfolk Street, London, W.C., have been re-appointed sole advertising contractors to Gloucester Corporation Tramways.

Leeds Electricity Committee have accepted the tender of the British Thomson-Houston Company, Limited, for lamps and H.T. switchgear, and that of Tramway Supplies, Limited, for H.T. switchgear.

Leeds Council have accepted the following tenders :—Castings, J. Henry, Limited ; lamps, British Thomson-Houston Company ; H.T. switch-gear, British Thomson-Houston Company and Tramways Supplies, Limited.

The British Insulated and Helsby Cables, Limited, have an order from Cardiff Corporation for 2,815 yards of three-core cable at £1,400 per mile ; 90 yards of armoured cable, and 465 yards of L.T. four-core pilot cable.

Cardiff Electricity and Tramways Committee have accepted the following tenders :—British Insulated and Helsby Cables, Prescot, 2,815 yards of 3-core cable at £1,400 per mile ; 90 yards armoured cable, £99 ; 465 yards low-tension, 4-core pilot cable, £159 per mile.

London County Council have allotted the following contracts for 1917 :—Supply of steel tires for tramcars, H. Bessemer and Company, Limited, and Cammell Laird and Company, Limited, each to supply 1,500 driving wheel tires, £3 5s. each, and 750 pony wheel tires, £3 2s. 3d. each.

Glasgow Electricity Committee have placed the following contracts :—Provision of mild steel chimney, Barrowfield Ironworks, Limited, £1,075 ; fitting stokers and fans on four boilers, Underfeed Stoker Company, £3,533 ; one set of turbo-alternators, condensing plant, and transformers, British Westinghouse Electric and Manufacturing Company, £91,564 ; one set of turbo-alternators, etc., Fraser and Chalmers, £94,678.

London County Council Contracts.—The Highways Committee have accepted the tender of the Western Electric Company at £24,921 for the supply and laying of cables required in connection with the additional supply of power for the Woolwich tramways. Other tenders were :—Siemens Brothers and Company, Limited, £25,799 ; British Insulated and Helsby Cables, Limited, £26,492. Hadfields, Limited, have been granted £3,000 for extra cost of materials and labour in the manufacture of special trackwork. For the supply of switchgear at Greenwich and Woolwich the tender of A. Reyrolle and Company, Limited, has been accepted. A large number of tenders have been accepted for the supply of tramway equipment, 1917-18. About 34,000 tons of coal for use at Greenwich generating station was purchased during the quarter ended March 31 at a cost of about £57,000. The construction of the additional condenser waterpipe at Greenwich station is to be carried out by John Cochrane and Sons, Limited, on the basis of payment to the firm for the actual cost of the work, with a percentage of 2½ to cover central office charges, and £1,200 for contractors' profit. The contract with Brightside Foundry and Engineering Company, Limited, amounting to £5,537 for additional steam, exhaust, etc., piping at Greenwich, has been extended to include similar work in connection with the provision of the new condenser waterpipe for the station. The cost is estimated at £3,000.

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PERSONAL.

Mr. T. Medcalf, tramways manager of Swindon, has been granted an increase in salary of £25.

Mr. William Murray, tramways manager of Walthamstow, has been granted an increase in salary of £50 per annum.

Mr. W. C. Bersey has been appointed a member of the Highways Committee of the London County Council in place of Mr. W. Haydon, who has resigned.

Mr. G. W. Humphreys, chief engineer of the London County Council, has accepted a commission in the Engineer and Railway Staff Corps, R.E.

Sir George Askwith, Chief Industrial Commissioner, has transferred his office from Old Palace Yard to the Ministry of Labour, Montague House, Whitehall, S.W.1.

Mr. George A. O'Hanlon, of the British Berna Motor Lorries, Limited, has received the freedom of the City of London as Liveryman of the Worshipful Company of Glaziers.

Mr. G. H. Hume, chairman of the Highways Committee of the London County Council, has been elected as the representative of the committee on the General Purposes Committee.

Mr. H. P. Stokes, electrical engineer and tramways manager of Bexley Urban District Council, has been granted an increase in salary of £100 per annum as from January 1, 1917.

Mr. J. B. Hamilton was recently elected a director of the Bath Electric Tramways Company, and appointed chairman. At the annual meeting of the company his election was confirmed.

Councillor G. H. Pearson, secretary of the Leeds Branch of the Association of Tramway and Vehicle Workers, has accepted a position in the shipyards labour department of the Admiralty.

Mr. J. T. Fayle, traffic superintendent of Leyton Council Tramways, has been appointed traffic superintendent of Southend Corporation Tramways, and Mr. J. Daniels has been appointed driving instructor at Southend.

Mr. H. C. Watson, of Sheffield Corporation Tramways Department, and **Mr. W. M. Miles,** of the Electric Supply Department, have been allowed by the Corporation to give their services to the Government during the war.

Mr. Philip Lyle Riviere, of Messrs. Kennedy and Donkin's staff, was on May 22 appointed electrical engineer in the tramways department of the London County Council, at a commencing salary of £1,200, rising by instalments of £50 to £1,500 a year.

Mr. K. A. Scott Moncrieff, who has been re-elected to the board of the Indian Electric Supply and Traction Company, has been appointed the first chairman of a committee which has been formed to represent companies registered in London and operating in India.

Mr. J. McLennan Calder, chief assistant engineer, Reading Corporation Tramways, on the recommendation of the general manager, has been granted an increase in salary from £250 to £300, an increment of £25 on April 1 last, and by a similar amount a year hence.

Mr. H. A. Munday, chief clerk in the Electricity and Tramways Department of Erith Council, has been presented with a case of cutlery subscribed for by the staff on the occasion of his marriage, Mr. J. C. Williams, engineer and tramways manager, making the presentation.

Presentations to the King at Liverpool.—Among those presented to the King at Liverpool on May 15, on the occasion of the Royal visit to the munition works, were Sir Charles Petrie, Mr. E. Russell Taylor, chairman of the Tramways Committee, Mr. J. A. Brodie, city engineer, and Mr. C. W. Mallins, general manager of the tramways.

Ex-Bailie Johnston, convener of Dundee Tramways Committee, has resigned his membership of the Corporation on account of the demands of his business affairs consequent upon his four sons being with the colours, and his assistants having been called to the army. He has proved an excellent administrator, and his resignation is regretted by his colleagues.

Mr. J. B. Patterson, who acted as electrical engineer at Lancaster since Mr. G. C. Milnes has been serving in the army, has been granted a bonus of £75, in addition to £50 awarded last year. It was remarked that Mr, Patterson had devoted ungrudging attention to the work, and had given the utmost satisfaction to the Electricity and Tramways Committees.

Glasgow Electricity Salaries.—The Glasgow Electricity Committee have increased the salary of Mr. W. W. Lackie, chief engineer and manager, from £1,100 to £1,400 by annual increments of £100; Mr. W. T. Calderwood, construction engineer, from £350 to £400; and Mr. R. B. Maccall, chief clerk and accountant, from £400 to £500 by annual increments of £50.

Inspector Nicholls has been promoted to the new post of motor superintendent in connection with Exeter Corporation Tramways. The position was created in consequence of the fatality caused by a car overturning on Fore Street Hill, and a communication from the Board of Trade emphasising the need for the exercise of care in the training of drivers and a strict examination before employment.

The Highways Committee of the London County Council has granted extra duty pay for special services rendered during 1914, 1915, and 1916, to Mr. T. L. Horn (resident electrical superintendent) and Mr. J. Terry (district traffic superintendent), £25 each; Mr. H. S. May (assistant rolling stock superintendent), £50; Mr. F. H. Wigner (second-class assistant), £20; and Mr. H. R. Docket (second-class assistant), £35.

Mr. G. T. Jackson, of Salford, owing to illness, has resigned the appointment of general secretary of the Amalgamated Association of Tramway and Vehicle Workers. Sympathetic references were made at the annual conference of the association recently, and it was agreed that Mr. Jackson's duties had been discharged with great ability for a period of twenty-seven years. The conference authorised the payment of a pension of £130 per annum.

Mr. William Marsh, engineer and manager of Brighton Corporation Tramways, has taken up duty as a technical officer to the Director of Shipyard Labour, his services having been lent to the Government by the Brighton Corporation. The Tramways Committee have congratulated Mr. Marsh upon the appointment, and have added that at the proper time they will give practical recognition to the good work he has done for the Corporation Tramways.

Sir Albert Stanley, President of the Board of Trade, made an effective maiden speech in the House of Commons on May 17, and explained the provisions of the scheme for the British Trade Corporation. Sir Frederick Banbury congratulated Sir Albert on his speech, but expressed strong dissent to the scheme proposed. Other speakers unfavourably criticised the project, and the debate was adjourned. Further consideration will be given to the matter.

Mr. J. M. McElroy, general manager, Manchester Corporation Tramways, has been appointed by the Board of Trade to act as arbitrator on the differences which have arisen between Liverpool and Bootle Corporations as to the maintenance of the Bootle Tramways, which are leased to the Liverpool tramways department. It is alleged that Bootle has not maintained the lines in the condition stipulated, with the result that the Liverpool cars have suffered damage.

Messrs. Bishop, Lamb, and Reid, of the Dundee Corporation electricity staff, have been awarded a bonus of £50 a year for the extra work they have done while the electrical engineer is with the forces. Councillor Nairn, in proposing the payment, stated that the department saved £300 on the engineer's salary by his army pay, so that the bonus would not cost the department anything. These three officials had not received any consideration since the war began, while all the other members of the staff had, and they had served the department very loyally.

Mr. I. Bulfin, general manager, Bournemouth Corporation Tramways, in his annual report, presented at the May meeting of the Corporation, referred to the loyalty and good work of the whole staff, many of whom were new hands. He also thanked the chairman and members of the Tramways Committee. The Council endorsed the remarks made by the manager as to the efficient work of the staff, and expressed to Mr. Bulfin their high appreciation of his services and of his very efficient conduct of the business of the undertaking during very strenuous times. Councillor Bell, chairman of the committee, added that the undertaking had the advantage of an energetic and clear-brained manager and an excellent staff. The committee took little credit for themselves, but desired that the manager and staff should have every credit.

Mr. G. F. Craven, general manager and electrical engineer, Reading Corporation Tramways, was highly commended at the May meeting of the Council, when unanimous assent was given to the motion to increase his salary from £600 to £800 by three instalments in two years. Alderman C. G. Field, chairman of the Tramways Committee for ten years past, said that during the past year the staff had been depleted and renewed, and the undertaking had been admirably managed during the war. The year was a record one in receipts, and it would also have been a record for net profits had not £625 been paid additional for income-tax. Since the commencement of the undertaking they had paid in rates £25,556, and had given in relief of rates £20,630. The reserve fund stood at £22,335. The capital outlay was £280,989, and £64,656 had been paid off.

The King's Visit to Manchester.—Among those presented to the King and Queen during their visit to Manchester munition factories on May 15 were Alderman James Bowes, chairman of the Manchester Tramways Committee and of the National Shell Factory in one of the tramway depots; Mr. J. M. McElroy, general manager of the Corporation Tramways, managing member of the Board of National Shell Factory, and director of the National Instructive Workshops, Manchester; Sir Kenneth Crossley, chairman of Crossley Brothers, Limited; Mr. W. W. Blunt, general sales manager of the British Westinghouse Electric and Manufacturing Company, Limited; Mr. H. Mensforth, general manager of works, British Westinghouse Electric and Manufacturing Company, Limited; Mr. J. Hoyle Smith, general manager of Belsize Motors, Limited; and Mr. A. P. Wood, general manager and director of the Lancashire Dynamo and Motor Company, Limited.

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WITH THE FORCES.

Mr. H. W. Sykes, chief clerk of the Northampton Corporation Tramways, has joined the Royal Garrison Artillery.

Private Wilson, formerly a Reading Corporation car conductor, has gained the Military Medal for gallant conduct in France.

Sergeant J. Gavins, West Yorkshire Regiment, who has been granted the Military Medal for conspicuous bravery, was an inspector on the Leeds Corporation Tramways before the outbreak of the war.

Corporal H. M. Dickinson, 2nd West Yorkshire, who enlisted from the car shed staff of Hull Corporation, has been recommended for a commission. The Tramways Committee have passed a congratulatory resolution.

Second-Lieutenant J. D. Ferguson, who was on April 28 reported missing in France, was chief engineer on the staff of Glasgow Corporation Tramways. After passing through the O.T.C., he received a commission in the Royal Scots in November, 1915.

Second-Lieutenant H. H. Hirst, son of Mr. Hugo Hirst, chairman of the General Electric Company, was married on May 9 to Miss Carol Lindon. Lieut. Hirst, who is on the roll of the Manchester Regiment, is attached to the Army Signalling Service.

Mr. G. W. Humphreys, chief engineer, London County Council, has been permitted to become a member of the Works Board proposed to be appointed by the Ministry of Munitions. Mr. Humphreys has also accepted a commission in the Engineer and Railway Staff Corps, R.E. (T.F.).

Sergeant W. S. Ling, a Highgate depot motorman who enlisted from the London County Council Tramways shortly after the outbreak of the war, has been awarded the Military Medal for conspicuously brave conduct at the front. He is serving in the R.F.A., and was previously for twelve years in the 5th Dragoon Guards.

Private E. H. Wilson, recently killed in France, is the first of the Burton Corporation Tramway employees to die for his country. Nearly forty of the men enlisted.

Sergeant-Instructor Travis, a former Oldham motorman, has been killed in action. In October last he was awarded the Distinguished Conduct Medal. Sergeant A. Danston and Gunner H. Hollingworth, two other tramway employees, have also been killed.

Corporal E. Bartlett, R.F.A., formerly a Cardiff conductor, has been killed in action. He enlisted in August, 1914, and he was awarded the D.C.M. for bringing a gun into action under a heavy fire at a distance of seventy-five yards from the German lines.

Lieutenant W. P. Duff, M.C., who was reported as missing on April 23, and since feared to be killed in action, was the youngest son of Mr. Donald Duff, for many years manager of a London omnibus company, and now one of the directors of the London General Omnibus Company. Lieut. Duff was awarded the Military Cross for conspicuous gallantry, and was decorated by the King at Buckingham Palace in December last. Another of Mr. Duff's sons was killed in 1915, and a third is serving with the Black Watch in France.

The death recently occurred of **Mr. Rankin Kennedy** at the age of 63 years. Mr. Kennedy was well known in connection with electric lighting and power installations, and was the author of several books, among them "Modern Engines and Power Generators," and "Electrical Installations."

Councillor Walter Wheatley, chairman of Hull Tramways Committee, was found dead on the floor of his bedroom on May 16. His death is widely regretted not only in Hull, but throughout the West Riding. He had held many public offices, including that of a member of the Court of the University of Leeds. He became chairman of the Tramways Committee last year at a critical period in the history of the undertaking. It was stated at the inquest that death was due to poisoning, and a note was found in deceased's handwriting stating that he was going to join his daughter, whose death he could not forget.

Mr. Benjamin Hall Blyth died on May 13, after a long illness. Mr. Blyth had been the chairman of Edinburgh and District Tramways Company since the formation of the company, and had piloted the undertaking through many trying experiences. Under his direction the company passed from a non-dividend paying stage to a period when substantial dividends were paid on every class of stock. During the past few years he devoted close attention to negotiations between the Town Council and the company, and he had the satisfaction of seeing better relations established recently. Mr. Blyth was born in 1849, and was educated at Merchiston Castle School and Edinburgh University. He was a civil engineer, and was professionally associated with the North British Railway Company, also acting as consulting engineer to the North of Scotland Railway Company. He was president of the Institution of Civil Engineers in 1915, and as an able expert witness he was often seen in the committee-rooms at Westminster.

TRAMWAY AND LIGHT RAILWAY NOTES.

BELFAST.

REPORT ON THE DISADVANTAGES OF PREPAID TICKETS.

Reporting to Belfast Tramways Committee on a suggestion that books of prepaid tickets should be issued at their face value, Mr. J. S. D. Moffet, the general manager, stated that none of the chief tramway undertakings, such as Bradford, Birmingham, Glasgow, Leeds, Manchester, Salford, and Sheffield, used such tickets for the very good reasons—(1) Difficulty of checking, (2) encouragement of waste, abuse, and fraud, (3) illegitimate trading in the tickets can only be kept within reasonable bounds by cumbersome and expensive methods, and (4) the extra expense incurred in connection with special tickets of this description greatly outweighs any benefit to be derived from their issue, as the additional traffic gain is negligible. Mr. Moffet was strongly opposed to the issue of prepaid tickets of any description, and the longer was his experience the more convinced he became that the proper course to follow was to reduce, and not to increase, the number of tickets in use; in other words, to make the fares as low as possible and to insist upon cash transactions on the car. The committee endorsed the general manager's opinion, and ordered the abolition of all prepaid tickets for at least one year, after which the matter may be further considered.

DEARNE VALLEY.

COST OF A LIGHT RAILWAY ORDER.

Even under the simplified procedure of the Light Railway Commissioners the expense of obtaining an Order to authorise the construction and working of a light railway can amount to a formidable sum. At a meeting of Wombwell Urban Council, at which a resolution was passed requiring the Dearne Valley Light Railway Board to publish without delay a statement of its expenditure to date, the clerk stated that the costs of promotion (taxed and discounted) amounted to £14,255, and Wombwell's share was £4,582. The Order was obtained in 1915, but no considerable expenditure had been incurred since.

GLASGOW.

PRIZE DRAWINGS BANNED—NO PLEASURE CARS THIS SUMMER—ANOTHER RECORD YEAR.

The Secretary for Scotland has informed the Glasgow Corporation that the sale of tickets on the tramway cars for the prize drawings in aid of various war charities is illegal and must be stopped. The department have endeavoured to arrange a meeting with the Secretary for Scotland to discuss the position. As a result of the sale of these tickets over £16,000 has been contributed to the war charities. Special cars are not being supplied this summer for pic-nic parties owing to the heavy nature of the ordinary traffic. The financial year which ended on May 31 discloses a revenue that for the first time exceeded one and a quarter millions sterling. The number of passengers shows an advance of half a million each week throughout the year. In two weeks during the last month of the year the passengers exceeded eight millions, which is more than the entire population of the city. So great is the pressure that it has been suggested that halfpenny fares should be suspended during the rush hours and at holiday periods. Allowances to dependants and extra wages on account of the war have raised the wages bill from £472,000 in 1913-14 to £630,000 for the past year, and the employees recently applied for advances totalling £50,000 per annum. The cost of material has gone up from 50 to 100 per cent. Eighty thousand pounds of the surplus will be required for the Common Good in order to meet the first instalment due to the banks on the sum of £2,000,000 advanced on the security of the undertaking for investment in the War Loan.

LEICESTER.

TRACK AND CAR MAINTENANCE IN 1916.

In his report for the year ended December 31 last, Mr. E. G. Mawbey, borough engineer, states that although the track has been in use for thirteen years it is, generally speaking, in good running order, but the time is approaching when extensive renewals will be necessary. During the year it has been impossible to obtain any heavy section rails, but the difficulty has been overcome to some extent by the use of manganese steel for the curves. Although this is more expensive in the first case it will be cheaper in the long run. Owing to the purchase of a comparatively large quantity of rails that was made when these were obtainable at a reasonable cost there is a fair stock for repairs and renewals. The track has been improved by the insertion of anchors, both joint and intermediate. Rail grinding to remove corrugations has been carried out. The length ground amounted to 41,015 yards and the cost was £219 15s., an average cost of 1·286d. per yard. The mileage of track is 38 miles, of which 17½ miles is double. Mr. T. R. Smith, engineer and manager, in his report, states that 160 passenger cars and three water cars have been maintained as perfectly as possible under somewhat adverse conditions.

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LONDON.

Obstructing Tramcars and the Defence of the Realm—Woolwich Track Doubling—Employees Killed by a Bomb—Track Maintenance—Boxes for Uncollected Fares—An Overcrowding Prosecution.

At the hearing of summonses at Woolwich against two motor vehicle drivers for obstructing the passage of tramcars, it was stated that such conduct in munition areas was an offence under the Defence of the Realm Act. In one case the defendant was fined 6s. and 30s. costs; in the other the magistrate, considering the defendant ought to have been warned of the proceedings, so that he might be enabled to prepare his defence, said that under the circumstances he would keep his licence clean and only order him to pay 12s. costs. Assent has been given by Woolwich Council to the immediate doubling of the tramway between Beresford Square and Parry Place, at the request of the Ministry of Munitions. The County Council having objected to any stipulations as to widening of Beresford Square and High Street, the matter has been remitted to a committee with power to act. While there was no liability under the Workmen's Compensation Act, the County Council on May 22 agreed to pay £300 and £293 in weekly grants to the widows of a motorman and a conductor who were killed by a bomb dropped from an airship last year. The amounts are those that would have been payable had the cases come within the Act. Complaints having been made in the constituency of Mr. G. H. Hume, chairman of the Highways Committee of the County Council, as to the condition of the tramway margins, that gentleman has pointed out that the wear is due to the use of the margins by heavy motor vehicles. That use is especially great under war conditions, and the permanent way staff are not able to cope with the extra work. Every effort is being made to improve matters. Replying to track complaints raised at a meeting of Ealing Council, the surveyor said he was informed that the company's depleted staff were doing their utmost to keep pace with the demands made upon them. Leyton Tramways Department have placed a box on each car with a request that passengers from whom the conductors are unable to collect the fares will place the money therein. The Metropolitan Electric Tramways Company on May 23 summoned a man at Highgate Police Court for contravening the bye-laws by remaining on a car already filled with passengers and refusing to leave. The company's solicitor stated that since the war the Board of Trade, in order to meet the public needs, had extended the bye-law which permitted excess passengers to be carried at special times, so that they could now carry a third extra passengers standing. On receiving an assurance that the bye-law would be strictly enforced, the justices imposed a fine of 10s.

MANCHESTER.

The Halfpenny Fare Restrictions.

On the Manchester tramways the halfpenny fares are in force on the circular and cross routes only, and not on the main routes. Children under sixteen years are carried at half the ordinary fares. During the year 1916-17 the number of adults taking halfpenny tickets was 15,275,313 out of a total of 219,151,984 persons carried, the percentage being 6·97. Halfpenny tickets issued to children numbered 20,711,898, a percentage of 9·46. The mainstay of the undertaking was the penny fare, which was paid by 144,578,484 persons, equal to 65·97 per cent.

PAISLEY.

Traffic Pressure Resulting from the War.

Paisley and District Tramways are, it is stated, carrying more munition workers in proportion to their regular services than any other tramway in the country. Twenty cars are sufficient for the regular daily traffic, but fifty-seven cars are employed to carry munition workers between the hours of 4 and 7 a.m. and 5 and 6.15 p.m. In fact, practically all the cars owned by the company are in service at these hours. Owing to a good stock of repair parts and other supplies purchased previous to the war, it has been possible for the manager, Mr. F. Coutts, to use regularly the whole of the rolling stock. Women have been employed in permanent way work and as conductors, but the manager has not felt justified in putting them on the front platform.

RAMSBOTTOM.

The Railless Service and War Difficulties.

Owing to the depot foreman of the Corporation railless trolley car undertaking having been called to the army, the manager, Mr. J. Wild, has had to undertake the man's duties in the shed. During the past two years Mr. Wild has combined the work of manager with the maintenance of the overhead equipment. With the present staff only one of the two cars in service will be fit to be worked. The military have failed to produce any substitutes. Councillor S. Plunkett, chairman of the Tramways Committee, recently stated that as soon as the undertaking was inaugurated the war broke out. If they could get the cars on the road, and the spare parts for repairs, the undertaking would come to somewhere near a profit.

ROTHERHAM.

Electricity Department's Achievement—Don Valley Development.

At a time when the cost of fuel has been rising for over two years, it is interesting to learn that notwithstanding the increased cost of operation the electricity department have maintained the same charges for power and traction as were in force in pre-war days without sustaining a loss. This announcement is made in the annual report to the Electricity and Tramways Committee by Mr. E. Cross, engineer and manager, who mentions that the average cost per ton for coal for 1915 was 8s. 10d.; for 1916, 9s. 8d.; and for the year ended March, 1917, 14s. 4¾d. It could be safely said, he adds, that the material, stores, and wages had gone up at least in the same ratio. The Electricity and Tramways Committee have recommended the Corporation to give full authority to their sub-committee to enter into negotiations and to complete an agreement for the purchase of the electricity station of the Mexborough and Swinton Tramways Company. The motive underlying this step is the anticipation of rapid industrial development of the Don Valley between Rotherham and Mexborough. The committee intend that the electricity undertaking shall be in a position as soon as possible to provide facilities that will attract new industries to the district.

WIGAN.

Conversion to Broad Gauge—Department to be Re-organised.

The Corporation have been informed by Ald. Fletcher, chairman of the Tramways Committee, that it is advisable as early as possible to convert the narrow gauge lines into broad gauge. The reconstruction will cost £33,000; £16,000 will be required for new cars and £16,000 for increased depot accommodation. It will be necessary to place £9,000 to reserve every year, and by re-organisation the manager hopes to raise an additional £5,000 a year. The committee propose to get the assent of Standish Council to a Provisional Order to remedy the inequality in the fares on that route, in order to increase the receipts. The manager has reported on the question of re-organising the shops and practically the whole department, and in order to secure efficient working Ald. Fletcher says it is necessary that his recommendations should be adopted.

Supply of Electric Vehicles.—Mr. Bryce, in the House of Commons on May 17, asked the Minister of Munitions whether he was aware that an active demand existed for electrically-propelled industrial vehicles, whereby the need for the import of fuel and fodder was diminished; whether the Edison Accumulators Company was licensed to produce only a very small number; whether it had been refused certificates to obtain the material necessary to complete even the licensed number; and whether he would grant priority certificates for such material?—Mr. Kellaway: It was in view of the demand that the Edison Accumulators Company was given a licence to manufacture a limited number of chassis in this country. No promise was or could be given that all the materials required would be forthcoming, but the necessary priority certificates will be issued in respect of vehicles ordered in connection with work of national importance.

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PATENT LIST.

Abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

*** If the inventions have been communicated the names of the communicators are given below in italics.

APPLICATIONS FOR LETTERS PATENT.

Starting apparatus for motor car engines (6,374)—Akt.-Ges. Brown, Boveri et Cie.
Reversing gears for friction-driven motor vehicles (6,254)—G. Barker and H. Stevenson.
Mechanism for operating clutches for motor vehicles (6,388)—G. Barker and H. Stevenson.
Combined anti-creeping rails and tie-plates (6,310)—B. B. Betts.
Systems of electric motor control (6,094)—British Thomson-Houston Company (*General Electric Company*).
Power transmission (6,265)—Leyland Motors, Limited.
Motor vehicles for traction (6,120)—J. K. Spittal.
Change-speed gear for motor vehicles (6,443)—Triumph Cycle Company and G. E. Stanley.
Motor road vehicles (6,063)—H. Steel.
Traffic signals (6,161)—J. Tomaszewski.
Fixing flanged light railway rails to metal sleepers (6,540)—W. H. Ashmore.
Trailers for commercial motor vehicles (6,563)—J. Banks.
Electrical signalling systems (6,542)—F. G. Bell and W. C. Davey.
Clutch and transmission mechanism for motor vehicles (6,575)—Birmingham and Midland Counties Transport Company and G. E. D. Ralls.
Automatic emergency control of steam and brake on locomotives (6,570)—T. H. Brett and G. M. Lubenetz.
Motor vehicles (6,628)—A. Good.
Lifting jacks for vehicles (6,511)—E. Gormly.
Electro-magnetically-operated brake mechanisms (6,584)—Ransomes and Rapier and R. S. Lewis.
Rail dressing machines (6,630)—G. Tanner (*Hanshue*).
Electric motor control systems (6,932)—British Thomson-Houston Company (*General Electric Company*).
Anti-skid and traction devices for vehicle wheels (6,888)—M. H. Cleaver.
Fluid-pressure braking apparatus (7,181)—J. W. Cloud.
Automatic slack adjusters for railway brakes (6,982)—A. R. K. Djurson.
Motor vehicle tires (7,155)—W. Farmer.
Motor vehicles (7,232)—J. H. Forknall.
Springing of motor vehicles (7,201)—W. L. Jones and A. C. Wickman.
Brake operating mechanism for automobiles (7,193)—H. Josephson.
Mounting driving wheels of motors upon road-wheel axles (6,874)—S. J. Murphy.
Installation and disposition of electrical equipment for motor vehicles (6,889)—T. L. Reepmaker d'Orville.
Engine suspension devices in motor cars (7,264)—G. Roesch and C. Talbot, Limited.
Rail ties (6,984)—E. H. Spalding.
Couplings for electric cables of railway vehicles (6,870)—J. Stone and Company (*M. Walton*).
Self-propelled vehicles (6,950)—Sir W. A. Tritton.
Swivelling trolley pulleys of overhead electrically-propelled vehicles (6,812)—A. Wood.
Axle boxes of railway and tramway rolling stock (7,508)—T. F. Craddock (*Burn and Company*).
Metal sleepers for permanent ways (7,535)—J. France.
Railway ties and fasteners (7,566)—F. P. Hunkle.
Insulators for supporting overhead electric conductors (7,403)—H. R. Lamb.
Railway trains and controlling same (7,506)—C. Lean.
Devices for lighting and heating vehicles (7,562)—Maschinenfabrik Oerlikon.
Wheels of tractors and motor vehicles (7,318)—Sir E. W. Moir.
Railway control apparatus (7,291)—J. Pattinson.
Self-starting mechanism for petrol vehicles (7,594)—L. Wirtz.

SPECIFICATIONS PUBLISHED.

1915.

System of railway control (17,143)—Craddock.

1916.

In the following list the numbers in italics are those that the specifications will finally bear and under which they will be indexed and abridged before acceptance and finally printed. The application numbers should, however, still be used for correspondence purposes:—

Method of electrically bonding rail ends (5,092—*105,378*)—J. C. Lincoln.
Life-guards for motor vehicles (5,235—*105,390*)—P. Deamer.
Motor vehicle bodies (7,895—*105,452*)—G. Maddox.
Steering mechanism for motor vehicles (18,347—*103,292*)—National Manufacturing Company.
Longitudinal sleepers for railway and tramway tracks (18,533—*105,527*)—O. Valeri.
Brake apparatus for railway vehicles (5,866—*105,628*)—E. S. Luard.
Brake slack adjusters for railway vehicles (5,871—*105,629*)—A. E. Hayward.
Friction driving gearing for motor vehicles (6,624—*105,643*)—J. T. Pickering.
Permanent way (8,182—*105,665*)—H. A. Rugeroni.
Coin or check freed turnstiles for tramcars (426—*105,770*)—H. Nathan.
Reinforced concrete railway sleepers (5,701—*105,786*)—C. C. Coade.
Lubricating the wheels and axles of railway and tramway vehicles (14,145—*105,861*)—J. Abbott.
Railway motor cars (15,550—*105,868*)—W. H. Buckingham and H. S. Johnson.
Fastening device for securing rails to metal sleepers (17,679—*105,877*)—H. A. Rugeroni.

Colonial and Foreign Tramways Traffic Returns.

NAME OF COMPANY.	1916. WEEKS ENDED.					1917. WEEKS ENDED.					AGGREGATE.		
	May 6.	May 13.	May 20.	May 27.		May 5.	May 12.	May 19.	May 26.		Wks.	1917.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Anglo-Argentine	54,938	54,974	52,485	52,770	...	55,638	53,048	52,654	51,429	...	21	1,080,824	− 592
Auckland	21,202	(28 days)	...	...	...	22,773	(28 days)	...	...	...	44	237,359	+ 5,453
Calcutta ... ... Rs.	68,947	65,723	66,213	63,215	...	68,233	66,747	65,465	64,527	...	21	1,423,415	+ 16,785
Madras ... ... Rs.	(14 days)	30,154	...	...	...	(14 days)	34,285	...	...	...	19	310,377	+ 28,753
Pernambuco	2,896	2,840	2,785	2,728	...	3,612	3,878	3,580	3,588	...	21	75,494	+ 12,698

Companies Issuing Monthly Statements.

	1915.	1916.					1916.	1917.					Wks.	AGGREGATE.	
	Dec.	Jan.	Feb.	March.	April.	May.	Dec.	Jan.	Feb.	March.	April.	May.		1916-17.	+ or −.
	£	£	£	£	£	£	£	£	£	£	£	£		£	£
Ballarat & Bendigo ...	4,437	3,399	3,512	3,881	...	...	3,980	3,521	3,196	3,422	...	...	52	42,747	− 974
Brazilian Traction Mlns.	7082000	6626000	6276000	6913000	6882000	...	6527000	7266000	6872000	7549000	7453000	...	17	29,140,000	+2,443,000
Brisbane	...	32,280	30,320	34,275	32,575	...	...	33,020	29,800	33,340	31,620	...	17	127,780	− 1,670
British Columbia $	603,667	591,949	572,935	446,401	421,265	...	631,644	627,130	581,555	456,626	447,429	...	43	4,513,808	+ 265,723
Buenos Ayres Lacroze	43,528	40,595	39,137	42,219	40,220	40,220	40,106	38,142	35,977	41,337	39,111	40,595	48	426,057	− 27,264
Burma	22,185	21,906	20,345	22,958	22,191	...	30,250	23,803	22,912	27,132	23,660	...	39	232,510	+ 26,377
Cape Town	...	16,030	...	14,994	...	...	...	18,440	16,229	17,688	16,705	...	17	68,962	—
Carthagena & Herrerias	2,129	2,841	1,585	2,991	2,513	2,927	2,399	3,982	3,223	2,955	4,366	4,321	22	18,847	+ 5,990
Cordoba	13,026	12,335	11,831	13,598	...	...	12,327	12,437	11,898	13,098	...	...	52	160,683	− 1,223
East India	2,062	2,015	1,863	2,196	2,116	2,161	2,120	1,836	1,570	1,647	1,445	1,455	43	19,140	− 1,727
Kalgoorlie	3,018	2,236	2,249	...	...	...	2,894	2,431	2,193	...	...	...	8	4,624	+ 140
La Plata	4,563	4,533	4,345	4,611	4,354	...	4,436	4,315	4,092	4,527	4,229	...	17	17,164	− 681
Lima	35,110	...	...	34,169	33,542	...	35,845	...	...	37,569	37,807	...	17	67,785	+ 3,684
Manaos ... Rs.	...	...	...	...	...	...	158,110	146,493	144,532	161,156	...	...	—	—	—
Manila ... ... $	...	...	66,303	...	...	...	...	...	73,200	...	...	...	—	—	—
Mexico ... $	...	...	...	...	...	...	...	...	...	...	...	...	—	—	—
Monte Video	31,305	34,252	32,502	31,956	28,997	...	31,364	33,341	32,304	31,979	29,230	...	26	186,622	− 797
Peruvian ... $	823,600	862,100	775,700	...	...	826,900	990,842	935,130	844,770	...	...	902,780	48	10,162,672	+1,328,675
Port Elizabeth ...	...	4,193	3,857	...	...	...	...	4,498	3,553	4,428	3,904	...	17	16,383	—
Rangoon	4,492	4,763	4,674	5,501	4,849	...	4,904	4,633	4,605	6,226	5,036	...	17	20,500	+ 713
Toronto ... $	...	906,350	846,256	910,969	883,209	...	...	1002469	932,567	...	970,367	...	17	3,896,595	+ 349,811
Winnipeg ... $	...	297,560	293,250	296,500	282,498	...	...	319,945	280,717	293,094	265,594	...	17	1,159,350	− 10,458

(*Continued on page 388*)

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TRAFFIC RETURNS—*continued.*

Tramways and Omnibus Undertakings in the United Kingdom.

NAME OF COMPANY OR CORPORATION.	1916. WEEKS ENDED.					1917. WEEKS ENDED.					AGGREGATE.		
	May 6.	May 13.	May 20.	May 27.		May 5.	May 12.	May 19.	May 26.		Wks.	1917.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Aberdare U.D. Council	402	335	346	...	...	386	394	402	...	...	6	2,601	+ 88
Aberdeen Corporation	1,997	1,663	1,741	1,818	...	1,894	2,167	1,856	1,945	...	51	96,268	+ 5,632
Accrington Corporation	553	549	557	...	...	694	627	601	...	...	7	4,090	- 137
Ayr Corporation	317	299	256	359	...	305	337	210	398	...	2	609	- 6
Bath Electric	*	...	...	...	...	...	...	...	...	...	—	—	—
Birkenhead Corporation	1,420	1,433	1,516	1,501	...	1,765	1,718	1,692	1,702	...	8½	13,276	+ 1,130
Birmingham Corporation	15,681	15,829	16,363	16,596	...	17,525	17,649	17,808	17,882	...	8	137,456	+ 4,395
Birmingham Corp. Motor Omnibuses	833	839	972	1,015	...	880	799	796	808	...	8	6,813	- 600
Blackburn Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
Blackpool and Fleetwood	619	419	478	524	...	582	415	562	521	...	20	7,854	- 915
Blackpool Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
Bolton Corporation	2,684	2,710	2,934	...	...	3,123	3,147	3,067	...	...	7	22,074	+ 794
Bournemouth Corporation	2,055	2,075	2,264	2,169	...	2,171	2,163	2,116	2,604	...	8½	18,718	- 822
Bradford Corporation	6,300	6,261	7,015	6,664	...	7,009	7,285	7,126	7,381	...	8	56,458	+ 777
Brighton Corporation	1,066	983	1,191	1,201	...	1,274	1,292	1,228	1,447	...	8½	9,946	+ 627
Bristol	4,798	4,587	4,829	5,221	...	5,645	5,499	5,518	5,648	...	20	100,553	+ 3,839
Burnley Corporation	1,705	1,646	1,677	1,680	...	1,766	1,751	1,737	1,761	...	—	—	—
Burton-on-Trent Corporation	257	251	264	254	...	267	265	278	293	...	18	2,172	+ 66
Bury Corporation	1,325	1,313	1,498	1,445	...	1,559	1,550	1,487	1,588	...	8½	12,477	+ 393
Cardiff Corporation	...	...	...	...	...	...	...	...	...	...	—	—	—
Chatham and District	1,235	1,137	1,240	1,328	...	1,322	1,296	1,380	1,397	...	21	23,831	+ 664
Chesterfield Corporation	...	257	268	285	...	...	272	276	269	...	8	1,976	- 248
Colne Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
Cork Electric	541	446	516	517	...	585	574	553	582	...	21	9,950	+ 287
Croydon Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
Derby Corporation	...	1,085	1,156	1,164	...	...	1,123	1,119	1,210	...	8	8,784	- 431
Dover Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
Dublin and Lucan	69	113	144	150	...	173	172	169	194	...	21	2,790	+ 294
Dublin United	490	4,186	5,947	6,208	...	6,718	6,584	6,602	7,078	...	21	126,723	+ 15,241
Dundee City	1,336	1,302	1,279	...	...	1,396	1,457	1,390	...	...	52½	71,874	+ 1,419
East Ham Corporation	1,297	1,256	1,283	1,402	...	1,382	1,383	1,963	1,372	...	8	11,198	+ 829
Exeter Corporation	371	346	376	392	...	388	379	373	388	...	8	2,840	- 143
Gearless Motor 'Buses	*	...	...	...	...	...	...	...	...	...	—	—	—
Glasgow Corporation	23,175	22,584	23,355	24,079	...	25,915	26,044	25,573	26,711	...	51½	1,227,167	+ 99,243
Glossop (Urban Elec. Supply Co.)	138	136	141	143	...	142	150	150	157	...	21	2,760	- 4
Halifax Corporation	2,280	1,932	2,072	2,350	...	2,141	2,277	2,299	2,172	...	7½	16,064	- 1,058
Halifax Corp. Motor Omnibuses	44	39	42	50	...	34	38	38	39	...	7½	315	- 28
Hastings and District	1,026	865	974	1,049	...	1,102	1,107	1,070	1,285	...	21	20,153	+ 2,867
Huddersfield Corporation	2,687	2,744	2,896	2,920	...	2,933	3,047	2,982	3,127	...	8	23,733	+ 118
Hull Corporation	3,002	3,033	3,131	3,139	...	3,211	3,132	3,251	3,289	...	8	25,722	+ 683
Ilford U.D. Council	694	643	691	...	...	709	706	884	...	...	7	4,955	+ 165
Ilkeston Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
Ipswich Corporation	445	463	513	572	...	517	600	656	694	...	8	4,219	+ 295
Isle of Thanet	314	263	340	348	...	307	277	281	322	...	34	8,375	- 729
Kilmarnock Corporation	171	199	163	161	...	169	204	175	172	...	1½	279	- 4
Lanarkshire	2,400	2,112	2,184	2,371	...	2,703	2,751	2,850	2,723	...	21	51,733	+ 6,341
Lancashire United	1,793	1,658	1,696	1,942	...	2,070	2,199	2,186	2,110	...	21	39,196	+ 4,453
Leeds City	9,160	9,100	9,772	9,914	...	10,527	10,606	10,484	10,831	...	8	82,324	+ 5,320
Leicester Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
Leith Corporation	774	810	819	876	...	962	940	938	1,031	...	1½	1,593	+ 203
Leyton U.D. Council	1,559	1,465	1,553	1,764	...	1,841	1,863	2,318	1,866	...	8	14,614	+ 1,670
Liverpool Corporation	14,024	13,953	14,124	14,472	...	15,658	15,389	15,708	15,746	...	20½	300,870	+ 19,641
Llandudno and Colwyn Bay	307	266	294	307	...	250	249	254	277	...	25½	5,197	- 560
London County Council	46,931	45,774	...	...	...	52,885	53,626	...	...	...	5½	280,866	+ 20,234
London General Omnibus	*	...	...	...	...	...	...	...	...	...	—	—	—
London United	*	...	...	...	...	...	...	...	...	...	—	—	—
Lowestoft Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
Maidstone Corporation	219	187	206	210	...	222	206	213	213	...	8	1,727	- 46
Manchester Corporation	18,393	17,961	18,545	19,079	...	20,285	20,361	19,839	20,429	...	8	156,655	+ 8,638
Metropolitan Electric Tramways	*	...	...	...	...	...	...	...	...	...	—	—	—
National Steam Car	*	...	...	...	...	...	...	...	...	...	—	—	—
Nelson Corporation	...	...	208	...	...	...	...	209	...	...	7	1,545	- 56
Newcastle-on-Tyne Corporation	5,980	6,158	6,488	6,548	...	7,451	7,435	7,636	7,789	...	8	58,288	+ 9,015
Newport (Mon.) Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
New St. Helens and District	972	855	902	1,094	...	1,144	1,232	1,185	1,199	...	47	51,500	+ 4,881
Northampton Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
Nottingham Corporation	3,692	3,617	3,777	3,946	...	3,986	4,066	4,238	4,205	...	8	30,737	+ 604
Oldham Corporation	2,267	2,321	2,614	2,513	...	2,717	2,778	2,615	2,814	...	9	23,909	+ 877
Portsmouth Corporation	2,637	2,496	2,678	2,850	...	2,909	2,732	2,775	2,878	...	—	—	—
Preston Corporation	1,099	1,045	1,044	1,144	...	1,111	1,120	1,151	1,133	...	7½	8,399	+ 142
Provincial	2,244	2,163	2,397	2,509	...	2,511	2,346	2,436	2,458	...	34	69,542	- 1,860
Reading Corporation	844	785	785	841	...	965	949	986	990	...	7½	7,083	+ 711
Rhondda Tramways	1,673	1,274	1,160	1,228	...	1,401	1,471	1,482	1,498	...	20	26,747	+ 3,136
Rochdale Corporation	1,648	1,658	1,747	1,807	...	1,893	1,955	1,880	1,999	...	8	15,444	+ 477
Rotherham Corporation	1,292	1,360	1,434	1,416	...	1,703	1,680	1,666	2,017	...	8½	14,804	+ 2,895
Salford Corporation	5,111	5,206	5,758	5,579	...	6,383	6,351	6,114	6,764	...	8½	50,835	+ 5,822
Sheffield Corporation	9,652	10,036	10,673	10,573	...	11,712	11,696	11,292	11,896	...	9	102,225	+ 10,377
Southampton Corporation	1,615	1,511	1,491	1,672	...	1,777	1,804	1,855	1,790	...	7½	13,253	+ 1,292
Southend-on-Sea Corporation	755	688	705	839	...	784	761	769	813	...	8	5,751	- 215
South Metropolitan Tramways	*	...	...	...	...	...	...	...	...	...	—	—	—
South Shields Corporation	728	735	805	808	...	862	845	879	920	...	8	6,904	+ 663
Sunderland Corporation	1,397	1,456	1,613	1,576	...	1,673	1,630	1,707	1,819	...	8	13,327	+ 549
Sunderland District	527	493	542	663	...	669	679	684	724	...	30	19,136	+ 1,941
Swindon Corporation	201	262	275	220	...	254	188	188	267	...	7½	1,868	+ 373
Torquay Tramways	824	666	518	540	...	606	576	559	572	...	20	9,685	+ 493
Tramways (M.E.T.) Omnibus Co.	*	...	...	...	...	...	...	...	...	...	—	—	—
Tyneside Tramways and Tramroads	675	514	507	546	...	725	762	767	789	...	20	12,735	+ 2,605
Wallasey Corporation	1,282	1,207	1,301	1,323	...	1,435	1,365	1,370	1,449	...	8½	10,751	+ 70
Walsall Corporation	754	774	813	...	...	891	885	892	...	...	7	6,188	+ 212
Walthamstow U.D. Council	1,039	894	1,080	1,219	...	1,234	1,236	1,351	1,261	...	8	9,327	+ 802
Warrington Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
West Ham Corporation	3,190	3,106	3,191	3,436	...	3,597	3,635	4,511	3,709	...	7½	27,696	+ 2,144
Wigan Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
Wolverhampton Corporation	*	...	...	...	...	...	...	...	...	...	—	—	—
Yorkshire (West Riding)	1,779	1,803	1,736	1,729	...	2,124	2,128	1,902	2,194	...	21	39,699	+ 4,918

* TRAFFIC RETURNS SUSPENDED.

Owing to the European war, the Government have taken over the railways of Great Britain as from August 4, 1914, and the issue of traffic returns has been suspended. Consequently the traffic returns of the electric railways which usually appear on this page cannot be given.

The Publication of the Traffic Returns of the Tramways marked with an asterisk in the above table have also been suspended during the war.

TRAMWAY DIRECTORIES.

A useful feature of this issue is the directory of electric railways and electric tramways which will be found among the advertising pages. This directory contains the names of the chief officials and the principal particulars relating to each undertaking.

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RAILWAY GAZETTE, March 31, 1916.

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Since the question of fuel supply is that which determines all else in the activities of motor transport, it is obvious that neither can its importance be exaggerated nor its interest exhausted. In the mere fact that restriction in petrol consumption became necessary under any conditions, there was justification for more alarm than was ever expressed. It would have been well, indeed, had matters been taken less calmly at the outset. At the same time one can appreciate the difficulties in the way of protest. The first petrol restrictions came in the guise of a necessary, not to say desperate, emergency measure, and for a variety of reasons the private motorist, who was the initial victim, could not very well complain. Therefore, as he remained silent, it was hardly to be expected that those who were at first outside the scope of the restrictions would concern themselves in the matter. Thus at the outset the community of motor users was divided into two camps, neither of which was disposed at any stage to help the other. This state of things was no doubt, imposed upon motor users, and not deliberately adopted by them, but one must insist that it would have been better, from all points of view, had they been able to unify their interests and take combined action when the petrol difficulty first arose.

* * * * * *

Such action might have had quite useful and valuable results, and in the long run would have had a very beneficial influence. It might, for instance, have compelled the Petrol Control Committee to approach its task very differently as compared with the manner in which it has been carried out. The necessity of some form of organised, but not captious, opposition has been demonstrated over and over again by the many blunders the committee has made in the details and routine of its work. No one suggests that these have been made out of malice or sheer irresponsibility, but they are susceptible to various other explanations. These range from the inevitable fallibility of mid-war emergency organisations to a suggestion of anti-motor bias, and, of course, our alleged traditional muddling must not be excluded. We have thus an all too consistent record of error in what may be called the minor issues, and it is not unreasonable to assume that, having been almost uniformly wrong in the smaller things, there is a very strong probability that it has also been wrong in those of greater import—that is to say, in its general policy. It is, however, possible that in this respect its mistakes may be found to be those of others. The committee was set up for a certain purpose, with functions somewhat narrowly defined, and it may be urged that these more or less strictly limited it to the task of conserving existing supplies of motor spirit that were available for civilian use, and that its duties did not comprise the creation of new resources.

* * * * * *

In any case, as the greater includes the less, it will be appropriate to direct any criticisms of the petrol policy to the Government itself, and if the suggestion just made does, in fact, represent the state of mind with which this problem was attacked when it first began to give anxiety to the authorities, it was undoubtedly wrong. One is compelled to inquire whether the first question asked by the Government on the subject was as to the possibility of new sources of supply being rendered available, or was it decided from the outset to impose limitations for reasons which primarily had only indirectly to do with difficulties of supply. The reasonable assumption, of course, would be that everything conceivable was done to increase the quantities of spirit produced and imported; that these having failed, "rationing" could not be avoided. But one remembers with some significance the anti-motoring campaign that commenced quite early in the war, and the suspicion that anxiety as to the quantities available or in sight was not the only factor that shaped the initial policy cannot be dismissed as groundless. Thus it is that the feeling is growing that the methods adopted by the authorities have been the reverse of what they should be. They have been too powerfully coloured by the suggestion that motor transport is still something new, and therefore still rather unessential, whereas, of course, its maintenance is of vital moment. Instead of trying, first of all, to get more petrol, and allowancing afterwards, should that prove unavoidable, they followed the plan of allowancing first, and taking other steps afterwards.

* * * * * *

A point has now been reached at which civilian consumption is at bed-rock, and any further reductions must have serious consequences, not merely to this or that set of interests, but to the whole fabric of national industry. A situation has, in fact, arisen which is more or less out of the Government's control, because the plain remedy is to-day tenfold more difficult than might have been the case a year or so ago. The restriction of supplies to any class of user ought to

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have been avoided as long as possible, but no one with a knowledge of the fact can feel that this was the principle upon which the Government acted. To this day in France there is no restriction whatever upon commercial and public passenger vehicles, and yet we are faced with a possibility of omnibus services having to be still further reduced, to say nothing of drastic curtailments of important commercial delivery facilities. One thing is quite certain, and that is that judged by results the policy of the British Government in regard to motor transport and petrol during the war has been exceedingly unfortunate, however excellent may have been its intentions.

To ascertain the effects of the war upon street traffic generally—but especially upon motor traffic—in the Metropolis one may turn both with profit and interest to the recently-published figures of the annual Fleet Street traffic census, which has been carried out by Mr. Hewitt Griffin for *Motor Traction* for eleven years past. It has been apparent to the most casual observation that the density of traffic in London thoroughfares is not what it has been, but, taking Fleet Street as typical, few would suspect that the reduction has been, roughly speaking, as 11½ is to 7, comparing the figures of April 23, 1914, with those of the same date this year. On examination in detail they are even more striking. Taking the same dates, one finds that the number of motor omnibuses has fallen from 3,551 in the last pre-war census to 2,036. Thus is afforded sufficient indication as to the extent to which omnibus services have, for one reason or another, been depleted. Nevertheless this decrease is in fairly close relation to both the diminution in the total volume of all traffic, and the percentages of the various types remains much the same as in pre-war days. Such modifications as there have been are most pronounced in very recent times, and during the last twelve months there has been a noticeable drop in the percentages of motor vehicles to the whole of each class of traffic specified. The reason for this, of course, is not far to seek. The petrol difficulties have all arisen within the last year, and in that same period the demands of the military authorities, both in men and material, have been growingly stringent. In addition there has been a series of prohibitions more and more wide in scope, affecting the manufacture and sale of vehicles and facilities for replacements and repairs. Indeed, when all the adverse conditions are taken into account, astonishment will be felt, not in the fact that there has been some relative decrease in the numbers of motor vehicles on the streets, but that such decrease has been so slight. So far as passenger traffic is concerned, the fall in the percentage of motor as against non-motor has been gradual and consistent since 1914, and only just lately has the rate of decrease become accelerated. Again, the reason is obvious, but even now the percentage of horse-drawn passenger vehicles to the whole of this class of traffic is only 5·16, so that this retrogression is really of no significance. As regards trade motor vehicles, the case is different. Here we find a sudden rise from just under 5 per cent. of motor to 95 per cent. of horsed vans in 1914, to nearly 11 per cent. of motors in 1915 and just over 12½ per cent. in 1916. For 1917 there is a fall to slightly under 12 per cent., but the fact emerges that of trade vehicles the proportion of motor-driven to horse-hauled is to-day well over twice the figures of 1914. Taking the total figures, the percentage of all motor traffic to all other traffic for 1917 is still higher than in 1914 or 1915, but not quite so high as last year. The foregoing does not even approach to an exhaustive analysis of those carefully and skilfully compiled statistics. It is only possible to recite the outstanding effects, and thus one arrives at the conclusion that, in spite of all the trials and difficulties and many discouraging and adverse conditions since the war, motor transport has more than held its own.

TECHNICAL COMMITTEE OF THE MOTOR INDUSTRIES.

A new committee, to be known as the Technical Committee of the Motor Industries, has been formed by the Institution of Automobile Engineers and the Society of Motor Manufacturers and Traders, in order to co-ordinate the many technical questions arising in connection with the automobile industry, which have been handled independently in the past. For instance, the Institution of Automobile Engineers formed a steel committee over two years ago that did much useful work for the purpose of standardising steels for use on automobiles, and they are also represented on many of the automobile sub-committees of the Engineering Standards Committee. The Society of Motor Manufacturers and Traders have at the same time been represented on those sub-committees, while various other technical matters have been dealt with by their Standardisation Technical and Research Committee, which has existed for some time.

By the pooling of interests it is hoped that not only will all overlapping be prevented in future, but that the committee, strengthened as it will be by the addition of representatives nominated by the various Government departments and institutions, will be recognised by the Council of Scientific and Industrial Research and all concerned as the proper body to treat with in technical matters connected with the motor industry.

Invitations to be represented on the committee have been accepted by the National Physical Laboratory (represented by Dr. Stanton), General Post Office (Capt. Wheeler), Institution of Mechanical Engineers (Dr. Hele-Shaw), Iron and Steel Institute (Mr. J. H. Dickenson), Commercial Motor Users' Association (Mr. Geo. Watson).

The Technical Committee will take over the work hitherto carried on by the Standardisation Technical and Research Committee of the Society of Motor Manufacturers and Traders, the Steels Committee and the Standardisation Committee of the Institution, and the Research Committee which is carrying out research on the E.S.C. British standard steels for automobiles with the addition of aircraft steels, which work is financed by a Government grant of £1,000 and a donation of £1,000 from the Society of Motor Manufacturers and Traders and the trade generally. It is hoped that by means of this organisation the voice of the industry will be heard in all the technical problems that are bound to arise after the war.

Further information can be obtained from either of the joint secretaries, Mr. Basil H. Joy, secretary Institution of Automobile Engineers, 28, Victoria Street, London, S.W.1, or Mr. T. F. Woodfine, secretary Society of Motor Manufacturers and Traders, 83, Pall Mall, S.W.1.

THE GOVERNMENT AND CHARS-A-BANCS.

The Commercial Motor Users' Association has been in negotiation with a Government department as to the possibility of sale to them of motor chars-a-bancs that have been lying idle since the Order in Council of August last prohibiting the use of motor spirit in chars-a-bancs. Whilst no guarantee can be given that sales will result, the Association are authorised to collect the following information in respect of each vehicle in an official list:—h.p., type, make, and date of manufacture of chassis; total mileage to date, and general condition of vehicle; class of body and seating accommodation; where chassis can be inspected.

The Association are also authorised to state that, in cases where chassis have been taken by the military authorities, and chars-a-bancs bodies left, particulars of such stocks of bodies will also be considered, with a view either to purchase or compensation. Owners who desire to avail themselves of the opportunity are requested to communicate with the Secretary, Commercial Motor Users' Association, 83, Pall Mall, S.W.1.

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ARMY MOTOR SPECIFICATIONS OF THE UNITED STATES.

PLANS THAT WILL ENABLE MAKERS TO CHANGE RAPIDLY FROM COMMERCIAL TO MILITARY MODELS.

The Motor Transport Board of the U.S.A. War Department on April 12 issued the new specifications for 1½- and 3-ton motor vehicles for the use of the army. These were prepared in accordance with the recommendations of the Truck Standards Division, the Springs Division, and the Electric Equipment Division of the Society of Automotive Engineers, and were approved by the Quartermaster General. In this issue we reproduce a first instalment of the new specifications, which are stated by the *Commercial Vehicle* (New York) to be a great improvement upon those issued last summer. In arranging the new specification full allowance has been made for the experience of the American army on the United States border and for the knowledge gained of the working of American trucks in the European war.

The specifications provide a vehicle which is entirely commercial except in a very few particulars, and those are such that the alterations would be simple. Such parts as are uncommercial can be provided for, even if not supplied to the commercial customer. This procedure would permit the makers to change over from their standard to the military type in days instead of months. Meanwhile the specifications are drawn so widely that twenty vehicles could be built to fill them and yet not be by any means the same truck. The main essentials are as appended, and the department have stated that departures from them will not be permitted :—

1. All forms of enclosed drive permissible.
2. Four-speed gear, direct drive on high.
3. Lowest gear ratio not less than 40 to 1.
4. Large engines required, 312 cu. in. on 1½-ton model and 414 for the 3-ton.
5. Minimum clearance of 9¾ in.
6. Only demountable tires acceptable, all of 36 in. diameter.
7. Electric lighting system necessary.
8. Engine must have three-point suspension.
9. Some form of locking differential necessary.
10. Tread varies from 58½ to 61½ in., according to size of tire.
11. Large brakes must be provided.
12. Large capacity radiators are necessary.

As to load capacity, nominally for a 1½-ton vehicle the pay load is estimated at 4,000 lb. to allow for rough usage. The body allowance is 1,050 lb. for the standard army body, while three men and truck equipment total 725 lb. This makes a total load on the chassis of 4,775 lb., or 1,000 lb. more if the pay load is taken to be 4,000 lb. instead of 3,000 lb. The chassis weight is limited to 6,000 lb.; so the whole vehicle when loaded would have a weight of 10,775 lb. For two-wheel driven trucks it is further desired that of the weight of the pay load not less than 80 per cent. nor more than 95 per cent. should be on the rear axle.

On the question of installing a speed governor, there was considerable difference of opinion. The trucks sent to Mexico mostly had to have the governors removed because the engine could not be accelerated enough on low gear to pull out of sand holes. Without the governor, however, the speed on high gear was destructive. In the original specifications drafted last year 14 miles per hour was the limit set; now it is raised to 15 miles, with the proviso that the engine speed must, at a governed speed, be such that the requisite power on low gear is still available. This is still further made evident by the clauses which define the minimum tractive effort at the rear wheels which will be accepted on both high and low gears. Herein the specifications introduce a novelty, i.e., the tractive factor. This factor is the result of dividing the tractive effort at the contact of tire and road by the total weight of the loaded vehicle. It must not be less than 0·0775 on high gear, nor less than 0·338 on low gear.

Lubrication must be by pressure. Dust extractors must be fitted to the main and auxiliary air intakes to the carburetter, and the crank case fitted with dust extractors. These must not require water. The petrol tank must hold 30 gallons, and there must be a partition dividing the bottom half of the tank, so that at least 6 gallons is retained on either side. Either gravity or pressure feed is permitted, the limitation being that the fuel must feed freely when the truck is climbing a grade of 25 per cent. or worse and with a minimum amount of petrol in the tank. Magnetos must be interchangeable.

Appended are the complete specifications, except for the general conditions under which tenders are to be rendered and the data to be supplied with tenders to provide such trucks. Those general conditions are of use to tenderers only, and were included in paragraphs Nos. 1 to 23 and in No. 279, which are eliminated from the data given herewith.

Specification for 1½-ton Vehicles.

Description.

24. *Load Capacity.*—The trucks must be of sufficient strength, and provided with sufficient power, to carry and propel the following gross load under the most severe service conditions :—

Pay load	3,000 lb.
Body...	1,050 lb.
Three men	525 lb.
Extra equipment	200 lb.
Total...	4,775 lb.

The extremely severe service conditions under which these trucks will be operated indicate that they should be designed for a nominal pay load of 4,000 pounds.

25. *Load Distribution.*—The distribution of load between front and rear axles, with the normal pay load equally distributed in the standard truck bodies herein specified, shall be not less than 80 per cent. nor more than 95 per cent. of the rear wheels in two-wheel drive trucks. In four-wheel drive trucks the total weight of the loaded vehicle shall be as equally divided as possible between the front and rear wheels.

26. *Weight of Chassis.*—The maximum weight of chassis, without body or extra tool and parts equipment, and without gasoline, water, or oil, must be not more than 6,000 lb. A definite statement must be made showing exactly what equipment is included in the stated weight.

27. *Road Speed.*—The governor on engine shall be set so as to give a road speed of 15 miles per hour, with a maximum engine piston speed of 1,100 feet per minute.

28. *Type of Drive.*—The trucks may be provided with any suitable standard type of drive, such as internal gear, bevel gear, worm gear, or chain drive. Preference will be given to that type of final drive which provides the greatest amount of ground clearance, in conjunction with provision for retaining grease or oil and excluding dirt.

29. Either two-wheel drive or four-wheel drive may be employed.

30. *Tractive Effort.*—The tractive factor obtained by dividing the net tractive effort at the tire surface of the driving wheels by the total weight of the fully loaded truck shall be not less than ·0775 on high gear, and not less than ·338 on low gear. This tractive effort shall be based on 85 per cent. efficiency of power transmission from engine to drive wheels on high gear, and on 70 per cent. efficiency of power transmission from engine to drive wheels on low gear.

31. *Ground Clearance.*—The ground clearance at all parts of truck, except at drive sprockets and hub brake drums, shall be not less than 9¾ inches. The ground clearance at the centre of truck between front and rear wheels shall be not less than 18 inches, and the difference between this centre clearance and the axle clearance may be decreased in proportion to the distance from the centre of the truck. The clearance under engine pan shall be not less than 11 inches.

32. *Wheel Base.*—The wheel base must be suitable for the use of a 10-ft. body, and shall be not less than 124 in. nor more than 150 in.

33. *Turning Circle.*—The truck shall be so designed as to turn in a circle of not more than 55 ft., measured from outside wheel tracks. Positive stops must be provided to limit the steering angle of the steering wheels.

34. *Gauge.*—The gauge of wheels on 1½-ton trucks, measured from centre to centre of felloe bands, shall be as follows :—

4-in. single tires	58½ in.
6-in. single tires	60½ in.
(Used on 4-wheel drive.)	
7-in. single tires	61½ in.

Engine and Cooling System.

35. *Engine.*—The engine must be of the 4-cycle type, water-cooled, having not less than four cylinders, and provided with mechanically-operated poppet valves. It shall have a total piston displacement of not less than 312 cu. in., and must develop a torque of not less than 2,000 in. pounds at not more than 1,000 ft. of piston speed per minute. The torque at 500 ft. of piston speed per minute shall be not less than 90 per cent. of the maximum torque. The engine must be under a removable hood, and located in a readily accessible position. The hood must be waterproof, readily removable without removing screws or bolts, and must open up

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sufficiently wide to permit of easy access to engine for inspection or adjustment. All main and connecting rod crank bearings shall be so designed as to be easily adjusted to take up wear. The piston pin bearing shall consist of a suitable phosphor bronze bushing properly secured in the connecting rod end. The valve-stem guides and push-rod guides shall not be cast integral with the cylinder casting, but must be separate parts, properly secured in place. The lower half of the crank case must be removed without disturbing the main bearings or the clutch housing, or removing the engine from the chassis. The unit power plant type of construction will not be permitted. The transmission must be mounted as a separate unit.

36. *Cylinders.*—The cylinders shall be cast from best quality grey iron, and must be free from sand holes, blow holes, cold shuts, or other imperfections. The bore of finished cylinders must be the same diameter from end to end, and finished to a tolerance of plus or minus 0·0005 in., for diameter and eccentricity.

37. The water-jackets of cylinders must be tested under a hydrostatic pressure of 100 lb. per square inch, which test they must withstand without leaking.

38. The cylinders must be rigidly bolted to the crank case by means of a proper number of stud bolts in crank case, and double nuts, or single long type of tight-fitting nuts. The stud bolts must accurately fit the holes in cylinder casting, the diameter of the hole being not more than 1-32 in. greater than the diameter of the bolt.

39. The water passages in jackets shall be of large area and volume, must extend entirely around the valve seats, and must offer as little obstruction as practicable to the flow of water. The water passages shall be so designed as to secure a uniform flow of water through all parts of the jacket. The water must circulate freely between the cylinders, and the jackets must be free from air pockets, or dead ends where the water is unable to circulate freely. The jacket space must be so designed that all water will drain completely from the jackets when the lower drain cock on radiator or water circulating system is opened.

40. The compression space in each cylinder must be accurately calibrated, and the cylinders selected so that the clearance volume of each cylinder is the same as that of any other for the same engine within 1 cu. cm.

41. *Pistons.*—The pistons shall be designed and constructed in accordance with the best standard practice. They shall be light in weight, heavily ribbed to secure proper strength, and made of best quality grey cast-iron, free from blow holes, sand holes, shifted cores, or other imperfections. They shall be properly annealed, machined with light cuts to avoid distortion, and ground to a high finish, proper tolerance, and a suitable clearance in cylinders.

42. The clearance between maximum diameter of piston and the diameter of cylinder bore shall not be less than 0·003 in. nor more than 0·005 in. They shall be properly tapered or relieved at the head end to provide for expansion, and shall have an internal stiffening flange at the open end.

43. Suitable means must be provided for preventing an excess of oil from working past the piston rings and into the combustion space, and at the same time securing proper lubrication of the piston and all bearings connected with the crank case.

44. The pistons shall be of such length as to give a low bearing pressure on the cylinder walls. The piston must also be so designed and constructed as to avoid slapping at all loads and governed engine speeds.

45. The pistons complete, with rings and piston pins, must be selected for weight, so that each piston will be the same in weight as any other piston for the same engine, with a tolerance of plus or minus half ounce.

46. *Piston Pins.*—The piston pins shall be hollow, with a wall of proper thickness. They shall be made of steel, of suitable quality for the purpose, properly hardened, and ground to a high finish and proper tolerance. The harness of piston pins shall not be less than 470 Brinell, as a base for comparative scleroscope readings.

47. The piston pin shall be a light driving fit in both of the piston bosses. The piston pin shall be fastened only in one piston boss, and the fastening must be made by an approved device which will positively lock the piston pin in the piston boss, and prevent it from coming loose.

48. *Piston Rings and Grooves.*—The piston shall be provided with at least three ring grooves of proper width and depth, all located between the wrist pin and the head end of piston. These grooves shall be ground to a high finish at the sides. Piston ring grooves to be finished as in S.A.E. practice.

49. If the triple type of ring is used, having one internal ring and two external rings, two ring grooves may be used, each provided with a triple ring, or one groove may be provided with a triple ring and the other with the ordinary type of single ring.

50. The single rings shall be machined to a high finish and proper tolerance on outside periphery, and ground on sides in accordance with S.A.E. recommended practice.

51. The rings must be of proper tension, and installed with only sufficient opening between the ends to provide for expansion of the rings under maximum temperature conditions.

52. *Valves.*—The intake valves and exhaust valves must be interchangeable, and made of alloy steel of best quality for the purpose.

53. The complete composition of the steel must be stated definitely, and all valves must be heat-treated to develop the proper physical properties.

54. The valves must be ground to a thoroughly gas-tight fit in the valve seat.

55. The valves must be constructed of one piece for both stem and head, must have a large radius fillet between the stem and head, and must be provided with 45 degree seats.

56. All parts of valve mechanism must be completely enclosed. If the engine is of the L-head or T-head type, the valve springs, stems, and tappets must be enclosed by a suitable readily-removable cover plate, and if the engine is of the valve-in-head type the overhead valve mechanism must be completely enclosed with a suitable readily-removable cover, or the bearings for rocker arms must be provided with suitable felt washers to prevent the entrance to dust or dirt.

57. *Valve Timing.*—The flywheel of engine must be provided with marks, referred to a readily-observable pointer or reference mark, showing the upper dead centre, lower dead centre, and the opening and closing positions of both inlet and exhaust valves, for each cylinder.

58. *Valve Stem Guides.*—The engine shall also be provided with suitable pressed-in or bolted-in valve stem guides. The use of valve stem guides cast integral with the cylinders will not be permitted.

59. *Valve Springs.*—The springs for both intake and exhaust valves shall be made of best quality steel, of proper strength for the maximum speed of the engine, and designed so as to withstand a long period of service without sagging or breaking. These springs shall be heat-treated to develop the proper physical properties.

60. *Valve Lifters.*—The valve lifter must be made of the most suitable steel and of proper design, with glass-hard wearing surfaces (not less than 90 scleroscope). It must have a suitable adjustment for height, which is easily accessible, and which will retain the adjustment and not shake loose. The adjusting device must be strong enough to withstand heavy strains with a wrench in adjusting without distorting or stripping of threads.

61. *Valve Lifter Guides.*—The engine shall be provided with suitable valve lifter guides of proper material, which will be either bolted or pressed into the crank case. The use of valve lifter guides cast integral with the crank case or cylinders will not be permitted.

62. *Connecting Rods.*—The connecting rods shall be of I-beam section, drop forged from steel equal to S.A.E. steel No. 1035, and properly heat-treated.

63. The crank end of the connecting rods shall be provided with bronze bushings faced with a proper thickness of best quality bearing metal.

64. These bearings shall be scraped to a proper fit with the crank, and in proper alignment at all positions of the crank, and for two-bolt rods shall be held in place with suitable dowelling. The bearing shall be provided with proper grooves and oil holes for lubrication.

65. The bearing on piston pin shall be in the connecting rod end, and a suitable solid phosphor-bronze bushing, pressed in, shall be used.

66. The bearing at each end of connecting rod shall be large enough to withstand long periods of severe service without the necessity of replacement or adjustment.

67. The cap end of connecting rod shall be made of the same material as the connecting rod, and shall be held to the rod and bearings by means of suitable bolts made of best quality alloy steel equal to S.A.E. specification No. 2330, or 3130, properly heat-treated to give an elastic limit of 80,000 pounds per square inch minimum, reduction of area 55 per cent. miminum, and elongation 18 per cent. in 2 inches minimum, provided with suitable castellated nuts and cotter pins.

68. The complete connecting rods for each engine must be selected for weight, so that each connecting rod shall be of the same weight as that of any other connecting rod for the same engine, with a tolerance of plus or minus one-half ounce. The crank ends of connecting rods, and also the piston pin ends, must weigh the same with a tolerance of plus or minus one-fourth ounce.

69. *Cam Shaft.*—The cam shaft shall be constructed of S.A.E. steel No. 1020, or alloy steel of best quality for the purpose, the cams

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properly case-hardened, and both the cams and bearings ground to a proper finish and size.

70. The cams must be forged integral with the cam shaft, and the bearings shall be of such size as to permit the shaft to be removed without removing the bearings, or the bearings must be readily removable with the cam shaft. The gear connection for cam gear shall be a flange, which is forged integral with the cam shaft and provided with a central boss for centreing the cam gear.

71. The cams shall be designed and ground to such shape as to secure quiet operation of the engine and maximum torque, and shall have wide bearing faces in order to prevent undue wear of the cams or valve lifters.

72. *Cam Shaft Bearings.*—The cam shaft shall be provided with not less than three bearings for a four-cylinder engine. The cam shaft bearings shall be of the best quality phosphor bronze or equal bearing metal. They shall be provided with an effective means for securing a proper circulation of oil through the bearings from the pressure oiling system.

73. *Gears.*—The cam shaft gear may be of cast-iron, but the smaller gears on crank shaft and on magneto, generator and pump shaft must be of steel. These gears must be machine cut, and all gears accurately adjusted to a quiet running fit under load. They must also have sufficient width to insure long wearing life. The cam shaft gear connection may be adjustable in order to permit proper valve timing, but must be provided with suitable means for retaining the adjustment.

74. *Crank Shaft.*—The crank shaft shall be forged from a single piece of steel, equal in quality to S.A.E. specification No. 1045, and heat treated to develop the following minimum physical properties :—

Brinell hardness 250-275 (scleroscope 41-45).

Reduction of area 45 per cent.

Elongation 16 per cent. in 2 in.

75. The crank shaft shall be sufficiently large in section at all points to prevent objectionable torsional or lateral vibration at all practicable engine speeds and loads.

76. Both crank bearings and main bearings shall be large in area in order to give low bearing pressures and long bearing life without replacement or adjustment. The crank shaft shall have not less than three main bearings for a four-cylinder engine.

77. The crank pins and main bearings of crank shaft must be ground to a high finish and a total tolerance of 0·0005 in. for eccentricity, and a tolerance of plus or minus 0·0005 in. for diameter.

78. The crank shaft must be accurately balanced for static and running balance, at the governed speed of the engine.

79. Suitable means must be provided for preventing cylinder oil from creeping out of the crank case at the end of bearings, or at any other part of the crank case.

80. The flywheel flange must be forged integral with the crank shaft. This flange must be large in diameter, and so designed as to secure an accurate centreing of the flywheel on the flange. The bolts used in fastening the flywheel to crank shaft shall be of suitable diameter, and of material equal to S.A.E. specification No. 2330 or 3130, properly heat treated to give an elastic limit of not less than 80,000 lb. per square inch, reduction of area of 40 per cent. minimum, and an elongation of 16 per cent. in 2 in. minimum. For inspection purposes these bolts must have a scleroscope hardness of not less than 35 nor more than 42. If the bolts take the driving strain they shall be of large diameter and tightly fitted in reamed holes in both members.

81. *Crank Case.*—The crank case is to be divided in a horizontal plane, with all bearings in the upper section. It must be so designed as to be light in weight and also of proper strength, and must be provided with suitable ribbing in order to secure a strong case free from distortion or weakness, and without excessive weight. It should be so designed as to permit any piston to be removed from its cylinder and taken out of the case without removing the cylinder or crank shaft.

82. All oiling receptacles, pipes, and oil guides, except the constant level troughs for connecting rods, shall be either pressed or cast integral with the crank case, or the oil pipes may consist of external leads. If external leads are used, they shall be short and rigid, or properly clipped to prevent vibration and chafing.

83. The oil settling chamber on engine must be provided with a suitable threaded plug for draining. The use of a drain cock will not be permitted.

84. The crank case must also be provided with an effective oil level indicating device, of the bayonet blade type.

85. The crank case must be a smooth casting, free from defects of material, design, or construction.

86. All joints or connections in crank case shall be made thoroughly oil tight.

87. The bearings shall consist of heavy split bronze bushings, and one set of these bushings shall be provided with side flanges to take end thrust. These bushings shall be faced with a suitable thickness of best quality bearing metal, and provided with proper oil grooves. The bearing caps shall be of proper design, and made of material suitable for the purpose. These caps shall preferably be held in place by means of alloy steel bolts of proper size provided with castellated nuts, with suitable cotter pins. Not less than three main bearings shall be provided in a four-cylinder engine.

88. The main crank shaft bearings and the connecting rod bearings shall be finished to an accurate bearing surface.

89. The main and connecting rod bearings shall be provided with laminated metallic shims, made up of sheets of equal thickness. The shim sheets shall be not more than ·0015 in. in thickness.

90. *Oil Capacity.*—The oil reservoir of engine must have sufficient capacity for lubricating oil to permit the truck to run fully loaded a distance of not less than 200 miles over ordinary roads without replenishing the supply of oil.

91. The oil filler and breather tubes on crank case shall be provided with a non-removable, fine mesh, brass screen, and also another screen of same construction which is removable. The filler tube cap shall be hinged and provided with a spring which will hold it in the closed position. This cap must not permit the entrance of water, and must also have a sufficiently large opening to properly vent the crank case.

92. *Lubricating System.*—The engine shall be lubricated by a pressure oiling system. The oil pump must be positive driven, and provided with suitable screens of not less than 30 mesh, and which are readily removable for cleaning. It is desirable that the oil pump and screens be so arranged as to make the screens self-cleaning by an intermittent reverse flow of oil. The inlet to oil pump must be a sufficient distance above the bottom of oil reservoir to provide a suitable settling chamber.

93. The oil pump must deliver a large volume of oil, and must maintain a pressure of not less than 30 pounds per square inch, at an engine speed of 800 revolutions per minute. A suitable relief valve on the oiling system must be provided.

93a. *Frictional Horse Power.*—The engines furnished with trucks must be thoroughly "run-in," so that the trucks may immediately after delivery be placed in continuous severe service without danger of damage to the engines. When the trucks are delivered the engines must be in such condition that the power required to drive any engine at 1,000 feet of piston speed, and with the fan and pumps in operation, shall not exceed 16 per cent. of the rated horse-power of the engine with wide open throttle at the same speed.

94. *Suspension.*—The engine must be mounted with a three-point suspension, or on a sub-frame having a suitable three-point suspension which will effectively prevent the distortion of the frame from straining any part of the engine, clutch, or transmission.

95. *Starting Crank.*—The starting crank must be readily accessible, and located in such a position as to be protected against damage from minor collisions. If necessary, it may be of the folding type. The removable type of starting crank will not be acceptable.

96. The engine and starting crank must be so mounted that the extreme distortion of the frame of truck will not prevent the ready engagement and operation of the starting crank.

97. *Governor.*—A centrifugal type motor speed limiting governor of approved make shall be provided and adjusted so as to prevent the truck from exceeding a speed of fifteen miles per hour on high gear. The governor shall be adjustable, and must have provision for sealing the adjustment and all connections of drive shaft with suitable lead seals.

98. *Engine Shield.*—Suitable means must be provided to protect the carburetter, magneto, and generator from water and mud. If a removable shield is used it must be fastened by means of spring clips which will permit it to be removed with the hands only, and without tools of any kind. In case the engine crank case is provided with cast or stamped webs equally as effective as the engine shield herein described, the engine shield will not be required.

99. *Carburetter.*—The carburetter must be of such design, and provided with such heating devices, as will enable it to utilise gasoline having an initial boiling-off temperature of not less than 122 deg. Fahr., a 25 per cent. boiling-off temperature of not less than 230 deg. Fahr., a 50 per cent. boiling-off temperature of not less than 300 deg. Fahr., a 90 per cent. boiling-off temperature of not less than 350 deg. Fahr., and a dry point temperature of not less than 400 deg. Fahr. The engine must utilise gasoline of the grade mentioned above, and at the same time operate with satisfactory economy and regularity at all engine speeds and loads.

The carburetter and engine intake manifold must be provided with S.A.E. standard flanges.

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100. The carburetter should be adjustable, and provided with means, readily accessible from the driver's seat and from the cranking position, for enriching the mixture when starting. The mixture must not be enriched by depressing the float, but this must be accomplished by the air control or the operation of the needle valve. If the mixture is enriched by the operation of the needle valve, the original carburetter adjustment must not be changed. A suitable drain cock must be provided at the bottom of the float chamber. The intake manifold must be provided with a suitable water-jacket, and the carburetter must be installed in as high a position as practicable. The use of aluminium in the construction of the carburetter will not be permitted.

101. *Dust Collector.*—A dust collector of suitable design and construction must be installed and connected with the carburetter main and auxiliary air intakes. It must be readily accessible for cleaning. It is desirable that the crank case breather tube be connected with the dust collector in order to prevent dust from entering the crank case.

102. *Muffler.*—The muffler must be of substantial construction, and so designed as to give the minimum back pressure and effectively muffle the exhaust. It must be so constructed and installed as to be readily taken apart for cleaning. The final exhaust not to be directed downward. The muffler must be provided with a suitable cut-out, with a spring which will hold the muffler valve positively in either the open or the closed position. The cut-out must not be operable from the driver's seat. The muffler must be located in such a position forward of the rear axle as to make it impossible for it to be knocked off due to the truck dropping into deep ditches, or passing over high ridges.

103. *Gasoline Tank.*—A suitable drawn steel gasoline tank, with welded joints, shall be provided, having a capacity of not less than thirty gallons. This tank shall be thoroughly tinned both inside and outside. Tanks with soldered joints will not be acceptable.

104. A metal partition shall be installed on the inside of tank of such height as to give a capacity of six gallons on each side of the partition. Suitable baffle plates shall be installed on each side of partition in order to prevent excessive splashing. The connection from tank to carburetter shall be made from the bottom of each compartment, through a three-way cock, thus giving a positive reserve supply of six gallons. A readily accessible shut-off valve shall also be provided in the gasoline supply line to carburetter.

105. If a pressure system is provided, the three-way cock may be installed at the top of tank with the supply pipes extending from same to the bottom of each compartment in tank.

106. A suitable gasoline strainer with drain cock shall be installed in a readily accessible location, and in the gasoline line between the tank and carburetter. The gasoline pipe line and pressure tubing shall consist of thoroughly annealed brass or copper seamless tubing, not smaller than three-eighths of an inch outside diameter, properly fastened at suitable intervals to prevent vibration or chafing, and arranged so as to completely drain through either the tank, carburetter, or strainer. All fuel and pressure pipe connections are to be S.A.E. standard fittings.

107. Suitable means must be provided for draining the gasoline from a flooding carburetter on to the ground without permitting any gasoline to get into the engine pan or to accumulate on any part of the chassis.

108. The gasoline tank must be installed high enough to permit the gasoline to flow to the carburetter when the truck is climbing the maximum grade which it is capable of negotiating under the most favourable road conditions, and with the minimum amount of gasoline in the tank. If necessary, a pressure feed system may be employed. The tank must be provided with a mounting which will prevent straining the tank due to frame distortion.

109. *Cooling System.*—The cooling water must be pump circulated, and the system must be so designed that it may be completely drained by opening a single drain cock. The drain cock must have a free opening not less than one-fourth inch in diameter, and must be located in such a position as to permit the water to run directly into a bucket placed under the drain cock. Thermo-syphon systems will not be acceptable. The water pump must be of such design as to permit thermo-syphon circulation in case of pump failure. The use of the gear type of pump will not be permitted.

110. The radiator must be of such design as to insure uniform and free circulation of water, and mounted in such a manner as to prevent damage to radiator due to severe vibration or twisting of the frame. It must also be readily repairable without special equipment. A tie rod with universal connection at the radiator end must be fitted.

111. All parts of radiator in contact with water shall be thoroughly tinned. Suitable baffle plates shall be provided in order to secure a uniform circulation of water through the entire radiator.

112. Ample area for the circulation of air through the radiator shall be provided, and also proper outlet area shall be provided to permit the free passage of the heated air away from the rear of engine. Suitable louvres shall also be provided in each side of engine hood. The hood should be supported independently of the radiator.

113. The radiator shall be of the fin and tube type, having cast or pressed upper and lower headers, with bolted-on cooling section or sections. If the cooling section consists of individual tubes with fins, the tubes must be not less than $\frac{3}{8}$ in. outside diameter. If the fins are continuous, the tubes may be a minimum of one-fourth inch in diameter. The overflow pipe must be of copper or brass, and not smaller than $\frac{3}{8}$-in. tubing.

114. The radiator shall have a frontal area involving section only of not less than 2·25 square inches per square inch of piston swept surface, and a total radiating surface in radiator of not less than 90 square inches per square inch of swept surface. The piston swept surface shall be obtained by multiplying the circumference of cylinder bore by the length of stroke by the number of cylinders.

115. *Radiator Hose.*—The distance between the ends of radiator hose connections and ends of hose connections of engine shall be not less than ·3 of the distance from the centre of third point of support to the centre of the hose connections of engine. The connections for hose on both engine and radiator must be not less than 2 in. in length. Both the upper and lower radiator hose must be non-collapsible.

116. A suitable fan and fan housing shall be provided, which will cause a rapid circulation of air through all parts of the radiator and insure proper cooling of the circulating water. The fan pulley and fan belt driving pulley must be so arranged as to permit of the ready replacement, adjustment, or removal of the belt. The fan belt and fan pulley must be constructed in accordance with S.A.E. standards. The belt shall be 2 in. in width, and provided with a spring take-up.

117. It is desired that the magneto, generator, coil, timer, battery, and muffler be kept as high as practicable.

118. *Starting Motor.*—Suitable provision must be made either on the engine or elsewhere for the installation of a starting motor, of proper size and design. The starting motor is not to be furnished, but the truck must be so arranged as to readily permit of its installation at any time if so desired. The flywheel must be provided with gear teeth for use with the starting motor. These gear teeth must be cut in accordance with S.A.E. recommended practice.

119. *Electric Lighting and Ignition.*—The truck must be provided with a suitable electric lighting system and dual ignition system. The electric lighting system shall consist of a generator driven from the power plant, a reverse current voltage cut-out, 100 ampere hour, 3 cell, lead acid battery, or 75 ampere hour 5-cell nickel-steel alkali battery, electric lights, fuses, wiring, and other necessary details. The ignition system shall consist of a high-tension magneto of best make, and a battery and coil ignition system. One distributor and one set of spark plugs may be used in common with the two separate ignition systems. The current for battery ignition will be taken from the electric lighting battery. Both battery ignition and magneto must be readily controlled from the driver's seat, and the spark advance lever on steering wheel must control both ignition systems, and give a suitable degree of spark advance for all positions of the spark advance lever. The range of spark advance shall not be less than 30 degrees of crank angularity. The full retard position of the spark lever shall retard the battery spark at least 3 degrees after top centre.

120. If the high tension magneto or generator is coupled to a driveshaft, two universal joints or a flexible coupling must be used in the driving connection, in order to prevent binding of bearings. The flexible coupling, if used, must provide for parallel and angular displacement.

121. *Generator.*—The generator shall be of the fully enclosed direct-current, constant voltage type, and must have a continuous capacity of 12 amperes. The voltage of the generator when installed on the truck shall be 8 volts at 1 ampere, and 7 volts at 12 amperes, within limits of plus or minus ·2 volt. The voltage regulation must be the same with varying engine speeds up to governed engine speed. It must be driven from the engine by means of suitable gears or silent chain drive. The gears or silent chain drive must be completely enclosed, thoroughly lubricated, and effectively protected from dust and dirt. If driven by means of silent chain drive, the chain must be readily adjustable. Definite data in reference to the material and construction of chain-drive gears must be given.

122. *Armature.*—The armature shall be of the laminated drum type, with the windings thoroughly insulated, and so installed in the slots as to effectively resist the action of centrifugal force at the maximum guaranteed speed of armature. After the coils are properly secured in the slots, and the armature coil terminals are

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securely soldered into slots in the ends of commutator segments, the entire armature shall be treated with an insulating compound by a suitable impregnating process. The insulating compound shall have suitable insulating qualities, and shall not soften under a continuous temperature of 250 deg. Fahr. The armature shall also be of proper electrical, magnetic, and mechanical balance.

123. Suitable means must be provided for preventing oil from the bearings from collecting on the commutator or armature.

124. Suitable anti-friction or sleeve bearings of best quality shall be fitted in each of the end frames. The bearings shall have proper means for ready lubrication, shall be a proper fit on the armature shaft, and shall not be so loose as to cause vibration of the armature at any practicable engine speed. The ratio of engine to generator speed must be given, and also the maximum permissible speed of the generator. The generator must be run at a constant ratio of engine speed, and no friction drives or constant speed devices will be permitted. The speed of generator in any case must not be more than twice the engine speed. The generator drive connection must be made direct with the engine, or with some part of drive connection between the engine and clutch.

125. The brushes of generator must be the self-lubricating type, having a spring take-up which will give a proper tension on the brush during its entire wearing life. The brushes must be easily accessible, and readily removed or replaced without removing or loosening other parts, and must have ample area of cross-section and area of contact to prevent excessive heating under continuous maximum permissible load. The brushes must be practically sparkless at all speeds, and at all loads from no load to maximum permissible load.

126. *Commutator.*—The commutator must be constructed of best quality hard copper of uniform density, and the segments properly insulated with sheet mica or micanite of suitable thickness and proper density to wear equally with the copper segments. The mica between segments shall be undercut approximately 1-32 in.

127. *Regulation.*—All voltage and current regulating devices shall be contained in assembly with the generator. No separately mounted controlling devices will be permitted. The use of sliding contact devices for current or voltage regulation and the use of permanent magnets in the construction of generator is also prohibited. If a voltage regulating device is used it must be provided with suitable seal.

128. *Charging Speed.*—The generator shall begin to charge the battery at an engine speed of not more than 500 revolutions per minute, and at the same time furnish the current necessary for ignition.

129. *High-tension Magneto.*—A high-tension magneto of best make must be installed on the engine, and positively driven either by gears or by a silent chain drive. If driven by gears, the gears must run in oil, and if driven by silent chain drive, the chain must be readily adjustable. In either case the chain or gears must be completely enclosed and thoroughly lubricated. The magneto must be arranged for clockwise rotation. Both the magneto and the mounting for same must be constructed in accordance with S.A.E. recommended practice.

130. The magneto must be provided with a suitable waterproof cover of proper construction, arranged so as to be securely fastened around the magneto and readily removable.

131. The magneto must be so designed as to exclude dust, water, and dirt, and must be provided with a suitable water and dust-proof cover of proper material and construction, and arranged so as to be securely fastened around the magneto and readily removable.

132. One distributor may be used in common for both battery ignition and for the magneto. The distributor must be of the waterproof type, and provided with a suitable safety gap.

133. The breaker points must be of platinum-iridium, and the breaker box and contacts must be easily accessible and readily adjustable. The breaker box must completely enclose the breaker mechanism, and prevent the entrance of dust, water, or dirt.

134. The magneto must be provided with a suitable spark advance arrangement, which will enable the magneto to deliver an adequate strength of spark at all positions of the spark advance lever. The definite range of spark advance must be given in the proposal, and must not be less than 30 degrees of crank angularity. The breaker box must be reversible, or provided with two levers on opposite sides.

135. The sector for spark advance lever must be plainly marked "Start" and "Run" for the most suitable battery starting and running positions.

136. With battery ignition the strength of spark must be adequate for all engine speeds, and the spark lag must be as small as practicable. The definite amount of spark lag in degrees of crank angularity must be given for all engine speeds, with a fixed setting of the spark advance lever.

137. Complete details of the construction of the magneto, with drawings and illustrations, must be submitted with proposal.

138. The guaranteed length of spark between needle points must be given with engine running at 100 revolutions per minute, and for both battery ignitions and high tension magneto the lag of spark in degrees of crank angularity must be given for all practicable engine speeds.

139. The primary and secondary cable shall be constructed and tested in accordance with the latest recommendations of the Society of Automobile Engineers.

140. *Tinning Test.*—All copper wires must withstand the following tinning test:—Samples will be properly selected to secure an average grade of tinning. The samples will have the insulation carefully removed, and the wires of cable carefully separated and straightened. The wires will then be thoroughly cleaned by means of ether, benzene, gasoline, naphtha, caustic alkali solution, or hot water and soap, whichever may be found necessary to thoroughly clean the wires.

141. The wires shall then be rinsed in clear water and wiped dry with a soft cotton cloth. The wires will then be immersed for one minute in a solution of hydrochloric acid having a specific gravity of 1088 at 70 deg. Fahr., and then rinsed in clear water and wiped dry as above specified. The wires shall then be immersed for 30 seconds in a solution of sodium polysulphide having an excess of sulphur, then rinsed in clear water and wiped dry.

142. The complete cycle of operations shall then be repeated, commencing with the immersion in hydrochloric acid and ending with the immersion in the sodium polysulphide solution.

143. Tests of tinning will be made on not less than ten sets of samples of reasonable length. All wires must withstand one immersion in the hydrochloric acid without blackening in the sodium polysulphide solution, and 75 per cent. of the wires must withstand three immersions in the hydrochloric acid without blackening in the sodium polysulphide solution. All tests shall be conducted with the solutions at a temperature of 70 deg. Fahr.

(To be concluded.)

SPECIAL PERMITS FOR HIRED CARS.

A notification was issued on May 24, under the Defence of the Realm Regulations, that the Petrol Committee of the Board of Trade will be prepared to issue special permits for motor cars to be let for hire for certain specified purposes in those districts where there are no motor cabs or other hackney vehicles standing or plying for hire in a public place or street or at a railway station. A special permit will be issued, subject to the condition that the hired motor car is used only for the following purposes:—

(1) For the conveyance of passengers to and from a railway station or port within a radius of 10 miles of the place at which the motor car is kept for hire.

(2) For the conveyance of duly authorised Government or public officers while engaged on their official duties.

(3) For the conveyance for business purposes of farmers to and from farms or markets.

(4) For the conveyance of veterinary surgeons while engaged upon their professional duties.

(5) For visiting persons who are dangerously ill, and for conveying nurses to attend patients, provided that in each case a certificate is obtained from a duly qualified medical practitioner.

(6) For funerals.

(7) For the conveyance of newspapers for distribution.

A record of all lettings of motor cars for hire, giving the names and addresses of the hirers and particulars of the journeys, shall be kept, and shall be open to inspection at any time if required. The permit must be carried by the driver of the motor car, and must be returned to the Petrol Control Committee immediately after the expiration of the period for which it is granted.

Applications for permits should furnish the following particulars to the Secretary, Petrol Control Committee, 19, Berkeley Street, London, W.1:—Name and address of owner of motor car, number of owner's motor spirit licence, purposes and period of hire.

Preventing Illegal Use of Petrol.

What should prove an effective means of preventing the illegal use of petrol and the alleged misuse of Government cars was adopted by the military district commanders in many parts of the country on May 26-28. By order of the Army Council, in conjunction with the Petrol Committee, examination posts were established on the principal roads. At these places many cars were stopped and the drivers requested to show their petrol licences. All cars containing officers or soldiers were similarly dealt with, and the occupants were also required to produce the passes giving leave of absence from their regiments.

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LONDON OMNIBUS WORKERS' STRIKE.

One interesting aspect of the strike of the London General Omnibus Company's employees between May 13 and 18 was the altered condition of the streets from a traffic point of view. The position before and after the withdrawal of the omnibuses is shown in the appended photographs.

The strike arose out of the repudiation by the Union of Licensed Vehicle Workers of their agreement of September 22, 1913, with the company that the latter should not be affected by disputes with traffic undertakings with which they have no connection. Upon that repudiation the company declined to recognise the union in an application for the war bonus of 10s. a week and other matters.

On May 17, at the request of the Prime Minister, Mr. Arthur Henderson met representatives of the company and the union, when terms were agreed upon with a view to a settlement, and traffic was resumed on the following day. The union withdrew their letters of May 3 and 4, thus resuming the relations existing prior to the repudiation, while the agreement entered into on September 22, 1913, is to be renewed at a conference to be presided over by Sir George Askwith. The application for a war bonus is to be proceeded with, any award to take effect as from the date on which work was resumed.

During the strike 125 vehicles remained in service, and a number of experienced motorists offered their services as drivers.

MOTOR VEHICLES FOR MUNICIPALITIES.

Shrewsbury Council are considering the question of purchasing a motor fire engine.

East Ham Council are sending a deputation to various places where electric dust vans are in use.

Walsall Gas Committee are considering the question of obtaining another motor lorry.

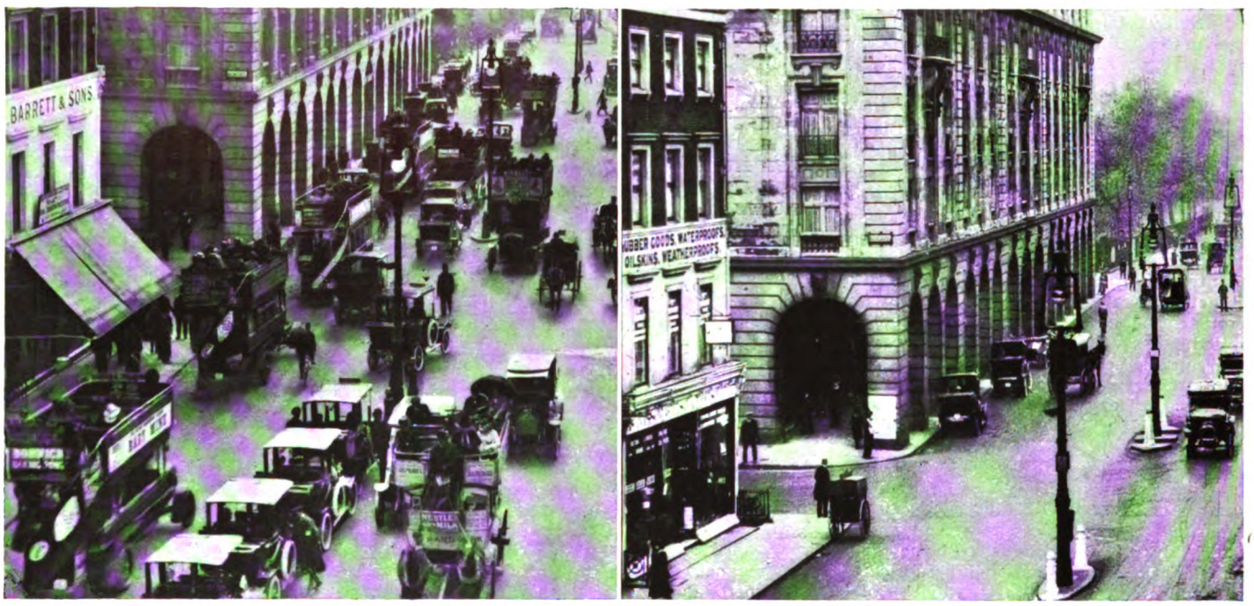
Bingley Council have directed the Highways Committee to inquire as to the cost of obtaining a motor wagon.

Ilford Council have received a very satisfactory report of the running of the electric coal wagon during the past year.

Sheffield City Council have resolved to purchase two more steam wagons from the Yorkshire Commercial Motor Company.

Bradford City Council have placed orders for two more 3-4 ton steam motor wagons with the Yorkshire Commercial Motor Company, at £650 each.

Tarvin Council have decided to hire a motor wagon at £3 a day, although Foden's, Limited, of Sandbach, had offered to supply a new one at £710.



A View in Piccadilly Before and During the Omnibus Strike.

Albion Company Obtain an Injunction.—Mr. Justice Asbury, on May 8, pronounced judgment in the Chancery Court in a case which had occupied his attention for two days. An injunction was applied for by the Albion Motor Car Company, Limited, of Scotstoun, Glasgow, and 21, Upper Rathbone Place, Oxford Street, W., against the Albion Carriage and Motor Body Works, Limited, of Albion Gardens, Hammersmith. The point at issue was whether the defendant company were entitled to use the word "Albion" as part of their name. A large body of evidence was laid which showed that the plaintiff company was known in the trade as the Albion Company, and their motor cars as Albion cars. After reviewing the authorities, and particularly the recent case of the Buttercup Dairy Company, decided in the Court of Appeal, Mr. Justice Asbury pointed out that although there was no substantial evidence of mistakes having actually been made it was impossible on the evidence to hold that the name of the defendant company was not calculated to mislead people who know of the reputation of the plaintiff company into the belief that the defendant company was connected in some way with the plaintiff company. That being so, his lordship stated that there must be the usual injunction with costs, but he gave the defendants two months within which to make the alteration in their name.

Notts County Council Highways Committee, in view of the economical work of the steam tractors already purchased, have included in the estimates a sum of £930 for the purchase of a Clayton and Shuttleworth 5-ton steam wagon and two 3-ton trailers.

South Shields Council have received delivery of a motor fire engine from Leyland Motors, Limited, Leyland, Lancashire. The price of the machine was £1,117, and it passed most successfully a number of tests carried out in the presence of the members of the Corporation.

Surbiton Council have been informed by the contractors for new electrically propelled dust vans that they were unable to obtain the sanction of the Ministry of Munitions to the purchase of steel for the bodies and tipping gear. The Council have resolved to have temporary wooden bodies fitted.

Derby Council have purchased an Edison battery omnibus from the Loughborough Road Car Company for £825, the original cost of the vehicle having been £1,133. It seats 22 passengers, and is licensed to carry 28. It is hoped by this means to do away with the loss on a horse omnibus route, disposing of eight or nine horses for £300.

Southwark Borough Council have purchased another motor gully wagon and a road washing machine from Straker-Squire, Limited, at £950 each. The Corporation have for a number of years been working the motor vehicles of this local firm. In a recent report the Works Committee stated that the "present machines are working very satisfactorily, and there is no doubt they effect an economy."

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MOTOR TRAFFIC.

MUNICIPAL MOTOR OMNIBUSES.

MANCHESTER.

In his annual report on the working of the Manchester Corporation Tramways in 1916-17, Mr. J. M. McElroy, the general manager, submits the financial statement of the working of the motor omnibus department. The number of miles run was 180,956, and 1,416,760 passengers were carried, as against 758,034 passengers in the preceding year. The appended statement gives the results for the past two years :—

	1916-17.				1915-16.			
	Per 'bus mile.				Per 'bus mile.			
	d.	£	s.	d.	d.	£	s.	d.
Traffic revenue ...	9·677	7,296	6	10	11·840	4,080	5	6
Traffic expenses—								
Superintendence, etc.	·299	172	13	3	·238	82	14	3
Drivers' and guards' wages	2·428	1,830	11	1	2·394	825	4	10
Bonuses and sick pay	·072	54	3	11	·099	34	9	2
Cleaning and oiling	·462	348	1	0	·363	124	10	7
Depot expenses ...	·147	110	16	8	·136	46	10	6
Ticket check ...	·190	143	5	2	·171	58	11	9
Uniforms	·083	63	6	8	·087	30	6	6
Licences and sundries	·056	42	5	0	·072	24	18	0
	3·667	2,765	2	9	3·560	1,227	5	7
General expenses—								
Salaries and wages administration ...	·147	110	16	8	·165	56	10	3
Rates on depots ...	·100	75	8	0	·096	33	1	6
Printing and stationery	·017	12	16	4	·020	7	4	9
Fuel, light and water	·016	12	1	3	·015	4	16	6
Compensation ...	·058	43	14	8	·098	34	7	3
Insurances	·022	16	11	9	·015	4	16	6
	·360	271	8	8	·409	140	16	9
Repairs and maintenance—								
Tires	·183	137	14	3	·592	203	18	2
Chassis	·727	548	4	11	·783	270	0	6
Bodies	·245	184	16	4	·229	79	6	7
Buildings and machinery	·049	37	14	0	·076	26	3	9
...	1·204	908	9	6	1·680	579	9	0
Power expenses—								
Petrol	2·813	2,120	11	3	1·521	523	2	2
Total working expenses	8·044	6,065	12	2	7·170	2,470	13	6
Depreciation	1·422	1,072	1	9	1·527	526	7	0
Balance to tramways account	·211	158	12	11	3·143	1,083	5	0
	9·677	7,296	6	10	11·840	4,080	5	6

WARRINGTON.

The Corporation's motor omnibus department's loss for the year ended March 31 last amounted to £519. Passenger receipts were £2,812, as compared with £3,127 the previous year. Other receipts amounted to £16. The expenditure was £2,737, leaving a gross profit of £91. Loan charges, however, amounted to £610, leaving a net loss of £519, as against a net loss of £396 in 1915-16. An amount of £525 was included in the estimates of the borough rate for 1917-18 to meet this loss. The curtailment of the service reduced the income by £301, but a corresponding reduction in the expenditure was not effected, mainly owing to the increased cost of petrol. The passengers numbered 757,115, as against 846,883 in 1915-16, and 771,510 in 1914-15. The receipts per mile were 11·176d., as against 9·706d. in 1915-16 and 8·804d. in 1914-15, while the expenses worked out at 10·815d. per mile, as against 9·027d. The loans outstanding amount to £1,749, against which there is £567 available in the sinking fund for the reduction of the debt, which will be finally redeemed by two further annual payments.

BOURNEMOUTH.

The annual report of the Corporation Tramways department for the year ended March 31 contains the following reference to the motor omnibuses :—" In regard to the motor omnibuses, the one from Westbourne to Alum Chine has been kept running the whole year. The receipts amount to £542, as against £504 last year. The passengers carried, 76,215, as against 72,531 ; and the miles run, 13,457, as against 13,529. The receipts work out at 9·67d. per mile, as against 8·93d. The omnibus from Boscombe Arcade to Boscombe Pier was kept in service from April 30 to October 20. The receipts amounted to £362, as against £409 ; passengers carried, 86,853, as against 98,223. The car miles were 7,063, as against 7,439. The receipts work out at 12·29d. per mile, as against 13·20d. The total receipts amount to £909, as against £1,035, and the expenses, £1,125, as against £1,158, leaving a deficit of £216 to be met by the tramways, together with the capital charges of same, amounting to £915. The main extra cost in running the omnibuses during the present year was due to the extra cost of petrol, 2s. 3½d., as against 1s. 5d. last year, working out at 4·63d. per car-mile, as against 2·38d. last year."

MOTOR COMPANIES' REPORTS.

John I. Thornycroft and Company.—A dividend of 1s. 6d. per share (7½ per cent.) is recommended on the ordinary shares.

Straker-Squire, Limited.—A dividend is recommended at the rate of 10 per cent. per annum, the same as in the previous period. That period covered the nine months to October 4, 1915, and the report now in preparation will cover the 15 months to December 31 last. It is stated that in the 1915 period the profit on the annual basis was practically double that for 1913-14.

South Wales Transport Company—This company, which is included in the British Electrical Federation, was formed in February, 1914, under the general managership of Mr. David James, of the Swansea Tramways Company, for the establishment of motor coach services in South Wales. In September of that year 26 vehicles were in operation, but on the outbreak of war 14 of them were impressed by the military, while all vehicles on order were taken at the works of the manufacturers. In spite of this disadvantage, the trading enabled a dividend at the rate of 6 per cent. per annum to be paid on the ordinary shares, which absorbed £821, leaving £1,400 to be carried forward, after £1,500 had been set aside to renewals fund. The year 1915 also proved satisfactory, while the year 1916 has enabled some financial measures to be adopted. The report, which was issued on May 28, shows that the net receipts amounted to £9,106. After deducting administration and general expenses, and £1,029 for mortgage and other interest, and providing £5,000 for renewals and depreciation, there remains a balance of £389, which with £1,320 brought forward, makes an available balance of £1,709, which the directors propose should be carried forward.

Low-bodied Dust Vehicles Advocated.—Among the methods of reform in methods of dust collection advocated by Mr. C. H. Cooper, borough surveyor of Wimbledon, is the adoption of low-bodied vehicles. In a paper read before the Royal Sanitary Institute on May 8 he stated that at least 100 men were required in London on account of the labour involved in emptying dust receptacles into the van from the top of the 4 ft. ladder the dustmen had to climb. In Paris and New York there were electrically propelled dust carts with low bodies, so that the pails could be emptied from the shoulder when the man was on the ground.

Cheap Omnibus Tickets withdrawn in London.—The example of the London County Council in withdrawing the cheap return tickets from the tramways has been followed by the London General Omnibus Company, which on Sunday, May 27, withdrew the ordinary cheap return tickets on routes 3, 21, 21a, 32, 34, 36, 36a, 47, 33, 53a, 72, 83, 93, 109. This does not affect the special return tickets issued to munition workers on the production of their identification cards, or the sale of cheap return tickets on routes 15, 99, 99a, 101, 101a, 101b, 103. The company are considering the question of continuing the halfpenny fares on omnibuses. Halfpenny fares in East London were stopped some weeks ago.

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MOTOR TRAFFIC.

MOTOR TRAFFIC NOTES.

OLDHAM OMNIBUS SERVICE.—Since the disposal of two of the Oldham Corporation omnibuses to Warrington Council the service to the Coppice has been run with only one omnibus.

RETURN LOADS FOR COMMERCIAL MOTORS.—Several Midland Councils have promised support for the scheme initiated at Birmingham to make the best possible use of road motor vehicles, especially in the matter of return loads.

TRANSPORT OF PRODUCE BY OMNIBUSES.—Acting in conjunction with the Markets Committee of Swansea Corporation, the managers of the Vanguard and Pioneer Motor Omnibus Companies have arranged to transport garden produce to the market from outlying districts.

MOTOR LICENCES IN WEST YORKSHIRE.—The West Riding County Council last year registered 410 motor cars and 407 motor cycles, and granted 14,653 driving licences, of which 8,065 were renewals. Under the Locomotives Act, 85 licences and 280 daily permits were issued.

ELECTRIC OMNIBUSES AT YORK.—The Tramways Committee recently stated that the charge for electricity supplied to the electric omnibuses for the year has been £737. It is estimated that had petrol been used, the cost would have been considerably over £1,000. The Committee are well satisfied with the electric vehicles and have recommended the Corporation to purchase another omnibus.

WELSH MOTOR OMNIBUS BILLS.—A Select Committee of the House of Lords, presided over by the Duke of Wellington, have considered the Bills promoted by the Caerphilly and Bedwas and Machen Urban Councils for a joint service of motor omnibuses. The committee allowed the Bills to proceed as regarded all the roads in the districts on which evidence had been given, and in respect to which there had been opposition. They adjourned questions as to additional routes.

HOW LEEDS HAS REDUCED STREET ACCIDENTS.—In his annual report to Leeds Watch Committee, the Chief Constable states that last year special constables were detailed for traffic duty at points where hitherto traffic constables were not stationed. The hours during which traffic points were controlled were also extended. The special constables allocated to this duty had shown marked ability for the work, and the zeal and intelligence which they had displayed had, in his opinion, been responsible for the reduction in the number of street accidents.

A WEEK'S OUTPUT OF KARRIER CARS.—The accompanying photograph showing sixteen Karriers in line represents a week's output of Karrier cars. It will be noticed that the cars are placed close together, in order to bring all the vehicles within range of the camera.

A section of the Carrier works is shown in the photograph, and on the left are the workmen's houses.

CONVENIENCE OF A THAMES VALLEY OMNIBUS SERVICE.—The London United Tramways Company have secured the assent of Kingston Council, as a war emergency measure, to the temporary suspension of the tramcar service between Ham boundary and King's Road, conditional upon the omnibus service to Surbiton station being uninterruptedly continued as under present conditions for the whole of each day at twelve minutes' intervals each way. If the omnibus service is withdrawn at any time the company will reinstate the tramway service.

LONDON MOTOR WAGON DRIVERS' WAGES.—On May 25 Sir George Askwith, Chief Industrial Commissioner, gave an award between the vehicle workers and the masters in the London area fixing the rates of wages for motor wagon drivers at not less than 50s., mates 35s., with overtime at 9d. and 7d. per hour, wash-out 5s. and 3s. 6d., and double-time wages on Sundays and holidays. He expresses the opinion that these rates should be adopted in the metropolitan area by other employers of road transport.

Dennis Lorry on Munition Work.

A YEAR'S WORK OF A LONDON OMNIBUS DRIVER.—According to some information recently given to the public by the publicity department of the London General Omnibus Company, the driver of an omnibus in the course of a year steers his vehicle safely many thousands of miles along country lanes, suburban highways, and crowded city streets, and something like 200,000 passengers are entrusted to his care and skill. There are 5,240 drivers on the books of the London General Omnibus Company, and of these 1,750 are at the front doing good work with the transport.

OMNIBUSES FOR A NEW DISTRICT AT JOHANNESBURG.—In preference to an extension of the tramways to the Newlands district the general manager of the Johannesburg Corporation Tramways has recommended the Council to start a service of omnibuses with the department's motor omnibuses, which are at present out of service. He states that there is no capital expenditure involved, and the necessary repairs to the omnibuses could be carried out at an expenditure of approximately £100. The cost of running a half-hourly service on the basis of running 16 hours per day at 1s. 6d. per car-mile, including capital charges, would be £3,504 per annum. Under this scheme the Council would be enabled to know the financial position at any time, as the takings would be kept separate from the tramway undertaking. If the running of this service proved satisfactory, the Council could at a later date consider the question of extending the tramway system.

U.S.A. MOTOR TRUCK EXPORTS.

The United States Customs records show that from August, 1914, to the end of February, 1917, a grand total of 46,590 commercial vehicles, valued at $126,904,401, were shipped abroad. By years these may be segregated as follows :—

	Number.	Value.
1914—August to December ...	2,981 ...	$8,337,515
1915—January to December ...	22,582 ...	60,052,246
1916—January to December ...	18,903 ...	52,870,774
1917—January to February ...	2,124 ...	5,643,875
	46,590 ...	$126,904,410

AMERICAN MOTOR EXPORTS IN MARCH.

The Customs records for March issued at New York show that 789 commercial motor vehicles were exported from that port in March with a valuation of $2,311,344, as against 604 in February with a valuation of $1,680,011. The British market absorbed 596 trucks in March, as against 234 in February. The valuation of trucks sent to England in March was $1,862,535 as against $692,691 in February. There has been a decline in the registration of commercial vehicles in England since the beginning of the year. The decrease was sharp in 1915 with an upward trend last year, which almost reached the pre-war figures. The total registration for 1914 was 22,191, for 1915 it was 15,656, and for 1916 the total was 21,358.

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SOLID RUBBER TYRES ON ACTUAL SERVICE

HOW TO OBTAIN SUPERB MILEAGE, RESILIENCE AND TOTAL SATISFACTION.

The all-important point—the basic factor—that concerns every buyer and user of solid rubber tyres, on the countless motor vehicles engaged in the tramway and railway world, is "lowest cost per ton-mile." To have a big wagon hung up for a day may represent a loss of £3, £4, £5, apart from the vexation caused (especially in these days of pressure) by the dislocation of your own and your customer's business. It is thus imperative to secure lengthy service and immunity from trouble.

As a practical and lucid answer to the question of how to obtain and maintain such a dual, desirable end, nothing could be more convincing than extracts from users' letters. Many testimonials have recently been received by Messrs. Geo. Spencer, Moulton and Company, Limited, a firm with over 60 years' experience, and with 46 years' associations as tyre manufacturers to leading railway companies. These tributes are plain, straightforward, and convincing, and tell their own story with adequacy. Appended are some excerpts :—

MANCHESTER, April 11, 1917.—"It looks like being some time yet before the last set (of Spencer-Moulton tyres) will give out. They were fitted in 1915. They have already done 15,000 miles, and look like doing a total of 20,000 miles. This has been done on all sorts of roads within seventy miles of Manchester on a 25 cwt. Lacre."

GLASGOW, November 9, 1916.—"We have ordered a new Sentinel steam wagon, and will thank you to arrange with Messrs. Alley and McLellan that this new wagon is fitted with your solid tyres. The two sets of your tyres fitted some time ago to our Scout cars are doing very well indeed, and we should like therefore to have your tyres fitted to our new Sentinel wagon. We may say that your tyres wear very evenly and most satisfactorily."

ECCLES, May 3, 1917.—"We are pleased to state that the various sets of Spencer-Moulton tyres we have used on our heavy commercial vehicles since 1915 are giving every satisfaction."

LIVERPOOL, April 3, 1917.—"The tyres supplied to us by you in February and April, 1916, are giving us every satisfaction."

STONECLOUGH, near Manchester, April 2, 1917.—"We have pleasure in stating that the Spencer-Moulton tyres supplied to us have proved very satisfactory, and we enclose an order for a further set for our 5-ton Foden wagon."

GLASGOW, March 26, 1917.—"We have pleasure in advising you that the solid tyres supplied to us during the past year are giving every satisfaction, and the mileage obtained is most satisfactory. We have fitted your tyres to various makes of cars belonging to us, and we are pleased to say that apart from the good wear your tyres are giving, we find them to be most beneficial to the chassis owing to their resiliency. We shall require some more of your solid tyres at an early date, and will advise you. We thank you for the very prompt attention you give our orders."

LONDON, January 22, 1917.—"We are pleased to inform you that the tyres fitted to the 3-ton Foden engines by you in May last are favourably reported upon by our Plymouth and Salisbury Plain agents, and are still giving satisfaction."

KENT, December 15, 1916.—"We are returning to you eleven tyres removed from two of our Albion 3-ton chassis. They have in each case exceeded their 10,000 miles guarantee. We are replacing with tyres of your manufacture."

OLDHAM, December 18, 1916.—"I cannot allow the opportunity to pass without thanking you very much for the manner you despatched one of my motors from your works on Thursday, December 14, 1916. It was 10 a.m. when it arrived at your works, and left again at 11.15 a.m., having had two new tyres put on and sent away in one hour and fifteen minutes. Of course this is only the manner in which you have done my work previously; but in these times, when we are so busy, it has been extremely satisfactory to me to be able to keep my motors up to their work."

BATH, January 18, 1917.—"I am quite satisfied with the tyres, and will do my best to get any orders I can."

HASLINGDEN.—"My candid opinion about the tyres which we have, and they are Spencer-Moultons, is that they have every appearance of being a good set and likely to do us some good. There is not a crack or fault noticeable about them."

The outstanding feature of the foregoing *proofs* is the word "Satisfaction" as applied to Spencer-Moulton Solid Rubber Tyres in Actual Service. Much has been heard and written in the motor world during the last year or two about service and 100 per cent. efficiency; and Messrs. Geo. Spencer, Moulton and Company have clearly shown in practice how those desiderata are attainable. "Satisfaction" embodies Long Service, and justifies the apt phrase which has come to be employed in connection with Spencer-Moultons as the Superb-Mileage Solid Rubber Tyres.

The testimonials quoted represent a haphazard selection from various parts of the country—not just from areas where good and level roads abound. Quite the contrary, as the reader and tyre-buyer can see at a glance.

By a process of selection, it would be easy to elaborate this page argument concerning Tyres of Satisfaction. For example, some Spencer-Moulton tyres running in and about London up to last autumn had done about 15,000 miles, and some months later were reported to be still doing good service. The letters quoted from are just a casual collection of commendations from customers.

Railway companies have had experience of the prompt service rendered at the Spencer-Moulton fitting works. This quick attention in the hustle days of war is illustrated in the Oldham letter quoted from.

Super Quality is a feature of Spencer-Moulton Solid Rubber Tyres.

Reference is made in one communication to the Resiliency of these tyres, and to the benefit which accrues to the chassis from this factor. It is a point that commands the most careful consideration of every tyre-user, whether he be the owner of a large fleet or of one wagon. Resiliency is the result of super-quality in raw material, plus good workmanship and the priceless lessons of long experience. Resiliency reduces the vibration—the jolts and jars—on the whole mechanism of the vehicle. Good tyres are veritable shock-absorbers. They form a true buffer between the road and the motor. Spencer-Moulton tyres are *proved* to be Resilient.

Foden, Sentinel, Thornycroft, Dennis, Karrier, Pagefield—these are six well-known makes of wagons. The makers receive large consignments of Spencer-Moulton tyres.

Belsize, Guy, Star, Selden, Albion, Garrett, Leyland, McCurd, Robey, Burrell, Daimler, Austin, Clayton, Straker-Squire—these are amongst well-known makers of vehicles on which Spencer-Moulton tyres have been fitted.

Full particulars, List 101, quotations, etc., can be had on application to

GEO. SPENCER, MOULTON AND COMPANY. Head Office, Solid Tyre Department, 237-239, Deansgate, Manchester. Telegrams, "Solspen," Manchester. Telephones, 5180, 5181, City. Registered Offices, 77-79, Cannon Street, London, E.C.4. Works, Kingston Mills, Bradford-on-Avon.

Fitting arrangements in all parts of the kingdom.

DEPOTS AND DISTRICT SUPPLIERS INCLUDE :—

LONDON.—Spenser Street, Westminster, S.W.
GLASGOW.—65, 67, Bothwell Street.
LEEDS.—68, Albion Street.
BELFAST.—32, Linenhall Street (Spence and Johnstone).
BIRMINGHAM.—332-333, Bradford Street (Messrs. J. Buckingham, Limited).
BRADFORD.—52, Manningham Lane (Eric S. Myers).
CARLISLE.—14a, Botchergate (County Garage Company).
DUBLIN.—184, Gt. Brunswick Street (C. E. Jacob).
NOTTINGHAM.—Trent Street (A. R. Atkey and Company, Limited).
DERBY.—Beckett Street (A. R. Atkey and Company, Limited).
HUDDERSFIELD.—St. John's Road and East Parade (Atkinson and Company).
NEWCASTLE.—Pottery Lane (Forth Engine and Motor Works).

Railway stores managers and others are specially invited to communicate with reference to Electric Trolley Wheel Solid Band Rubber Tyres.

Spencer-Moulton Pneumatic Tyres are World-Famous for Light Commercial and Private Motor Cars.

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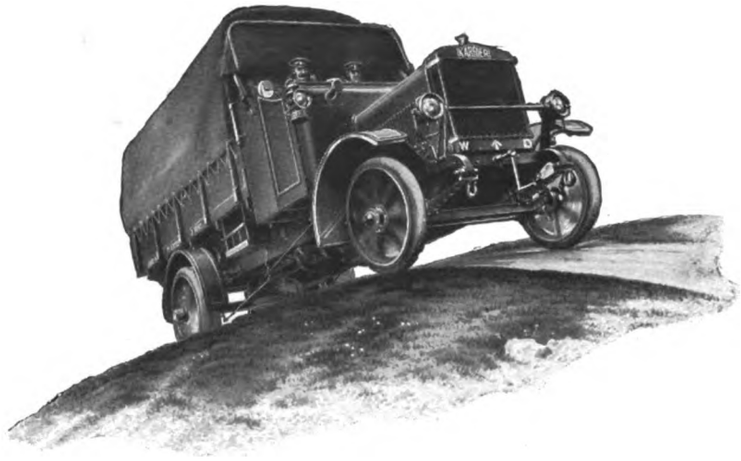
58 Ton-miles per gallon



And the lowest possible minimum for running costs and maintenance. Compare this with the capacity and efficiency of so-called "economical" vehicles of the converted or rebuilt class.

KARRIER

Vehicles are built for heavy loads, for hilly roads, for Power and Service. From "stem" to "stern" the Karrier is a masterpiece of Strength, Efficiency and Reliability. Note the accessibility, the ball-bearing transmission, the phosphor bronze bushing of minor details, Splining throughout, and the 50 h.p. engine.

Extensive tests on the stiff gradients of the Yorkshire hills have been unable to produce any signs of boiling.

Enquiries to
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BAKERLOO LINE AND L. & N.W.R.
THROUGH ELECTRIC TRAINS
NOW RUNNING

EVERY 15 MINUTES WEEKDAYS

UNDERGROUND

ELECTRIC RAILWAY HOUSE,
BROADWAY, WESTMINSTER,
S.W.1.

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"LIFE" IN SOLID RUBBER TYRES FOR ROAD MOTORS & ELECTRIC TROLLEYS.

It must be admitted by way of premise that a magnificent wealth of knowledge and experience are brought to bear by Railway and Tramway Managers, Boards of Directors, Committees, and others responsible (*a*) for purchase of goods, and (*b*) an adequate return for outlay. The volume of information gained by years of practical acquaintance plus the theoretical data accessible to these gentlemen are at once vast and admirable. As engineers and observers, many of them rank high in their profession, but there are always some details about which they must be ever open to discuss points of importance.

Take, for instance, solid rubber tyres, which are not exactly within the province of the mechanical engineer's special knowledge. These tyres are in use for every type of road-motor, from big transport lorries and light vans to chars-a-bancs and omnibuses; and they are in rapidly-increasing demand also for those splendidly-useful electric trolleys which move about so swiftly and silently—so quickly and quietly—about railway stations, tram-sheds, warehouses, factories, and workshops generally.

The range of sizes in solid rubber tyres is far greater than is generally imagined. Spencer-Moulton solid rubber tyres can be obtained in sizes from 10 inches in diameter up to 42 inches. A somewhat striking illustration in this connection was published in the TRAMWAY AND RAILWAY WORLD recently, showing two small electric trolley wheels with their little tyres, encircled by a giant tyre 42 × 7 for 36 in. rim fit.

This latter is ideal for 5 and 6 ton load transport, and fully capable of standing up to its work. These big tyres give plenty of "life" in a dual sense; they have a big degree of durability and wear—otherwise long life—and they have that "life" or liveliness or resilience which is so well understood in the motor world, namely, that property which helps the vehicle to run well and not "dead."

A properly-made tyre should possess "life" in its double meaning. It should have great wearability, and it should have "life" or elasticity in an accurately gauged degree.

A correctly-produced solid rubber tyre should be a veritable shock absorber. On the other hand, a tyre with too much "life" might bound or bounce along a road in a reprehensible manner, and subject the mechanism of the vehicle as well as the load (whether goods or passengers) to one everlasting series of jars and jolts, leaps and bounds, wherever the road is the least rough.

A happy combination of durability plus shock-resisting power (in other words, "life" in its double meaning as applied to tyres) can be produced only by expert india-rubber and tyre manufacturers.

It would be possible to make easily a tyre with too much "life" or resilience or elasticity. This requisite of resilience must be conjoined with the properties which make the tyre wear for a long period.

An able writer said some time ago in an article on india-rubber manufacture, "The duration of heating and temperature [in mixing raw rubber with other ingredients] have a great deal to do with the quality of the finished goods, and it is only after considerable experience that proficiency is gained in this branch of the work." There is sound sense and simplicity in those words.

Messrs. George Spencer-Moulton and Company, Limited, have had over 60 years' experience as india-rubber manufacturers. They have made tyres for leading railway companies for 45 years, and are at the present time supplying them with solid rubber tyres for road motors and electric trolleys. Spencer-Moulton tyres are fitted in big quantities by manufacturers of leading makes of chassis, and there is probably not a make of motor known but what can be found running on the same famous make of tyres.

There are so many details in the art of producing a solid rubber tyre with "life" (in its double meaning) that it is impossible to go far into them here. Take one detail, however. Every observant user of solid rubber tyres must have seen instances of tyres splitting and cracking through being too hard. This reduces the durability and elasticity of the tyre. In other words, the life of the tyre in both meanings is adversely affected. In this connection, again, it may be emphasised that the long experience of the Spencer-Moulton Company is a priceless asset in the production of their solid rubber tyres.

Resilience or liveliness in tyres is a factor much misunderstood by the non-expert. Webster's dictionary says resilience is "the capability of the strained body to recover its size and shape after deformation, especially when the strain is caused by compressive stresses."

To quote Webster again:—"Scientifically, elasticity is that property of a body which causes it to resist deformation and afterwards to recover its shape and size. From this standpoint a block of steel or glass would possess much greater elasticity than an easily expanded piece of rubber." For elasticity and resilience, therefore, from the purely scientific point of view, a glass or steel ball would be the most resilient of all substances. There is no need to pursue the thought as applied to tyres—it would become ludicrous—except to point out that resilience pure and simple is not the only factor required. It must be co-ordinated with durability and shock-absorbing qualities. The perfect union of resilience, prolonged wear, and shock-absorption is to be found in Spencer-Moulton solid rubber tyres.

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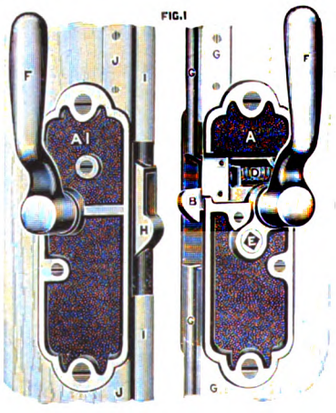
FIG. 1



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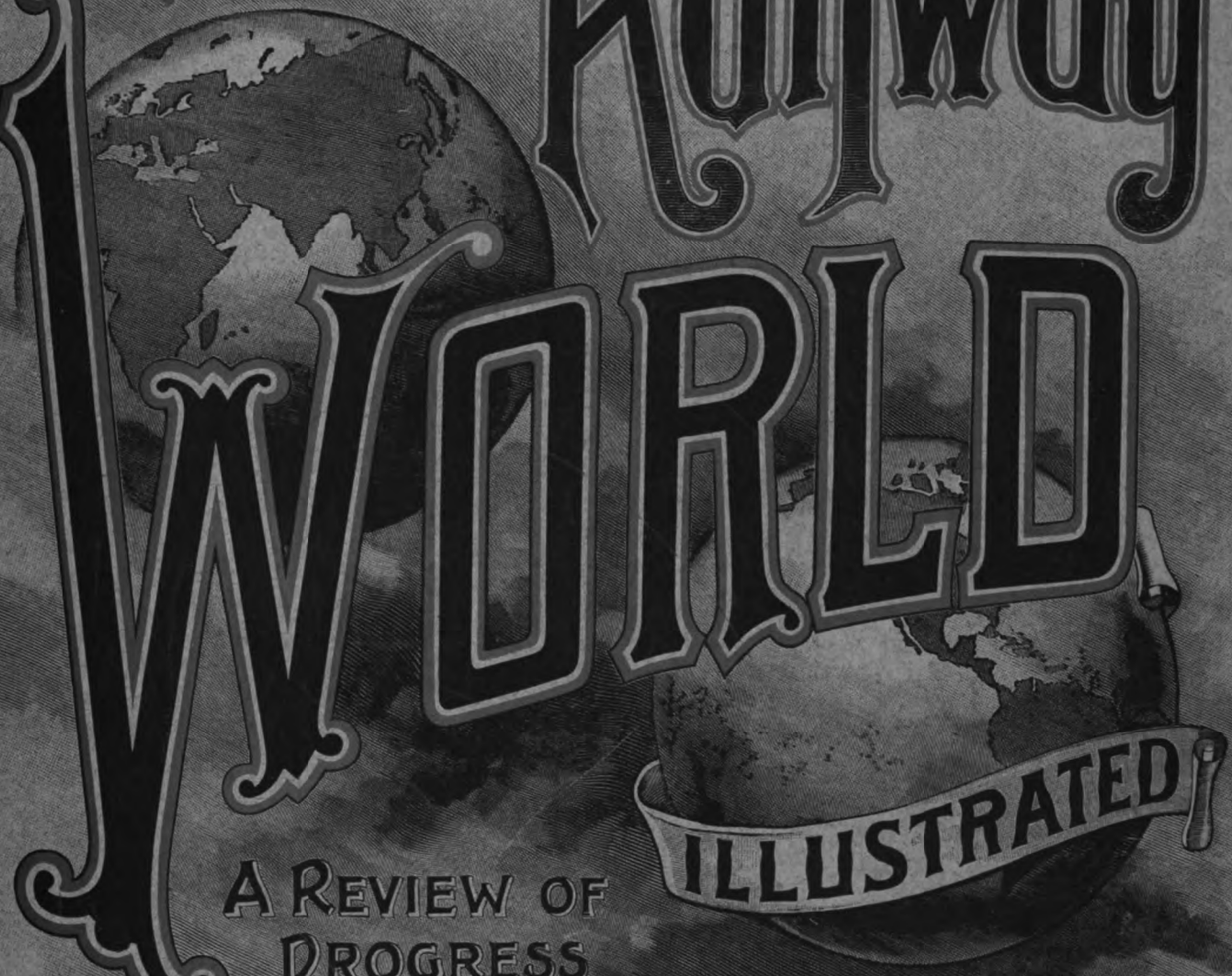

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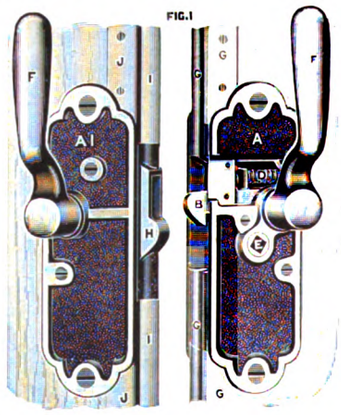
FIG. 1



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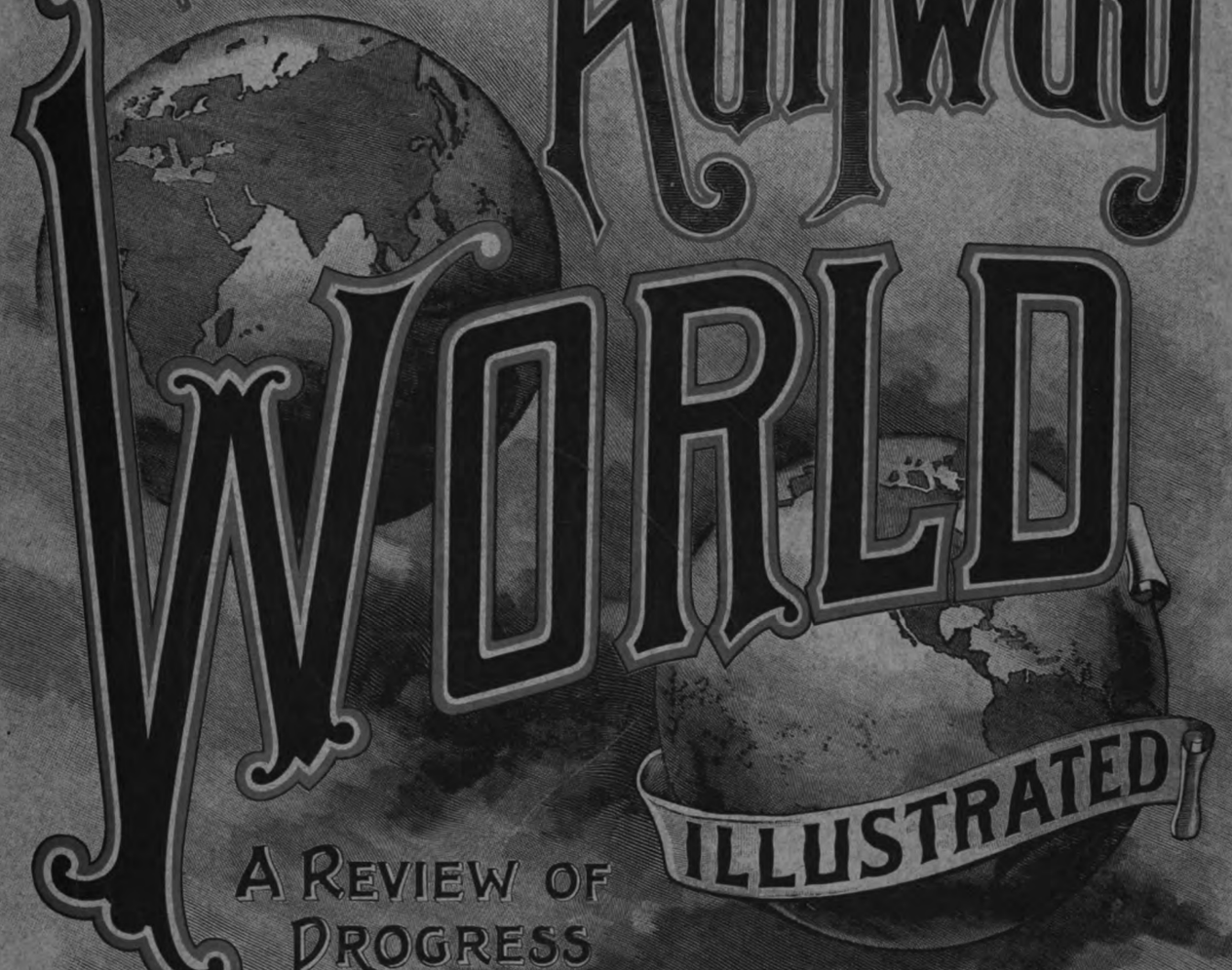

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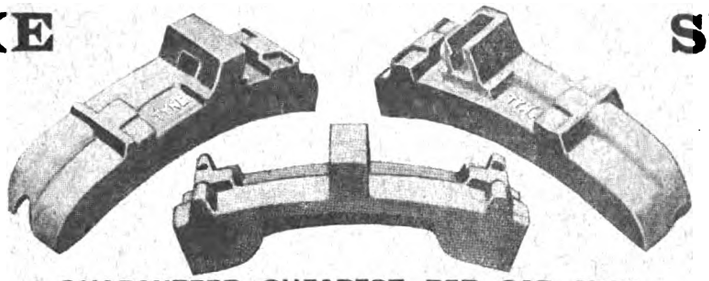

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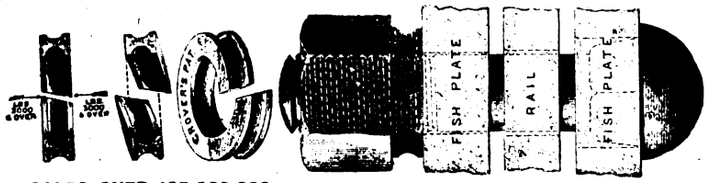

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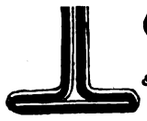

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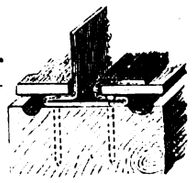

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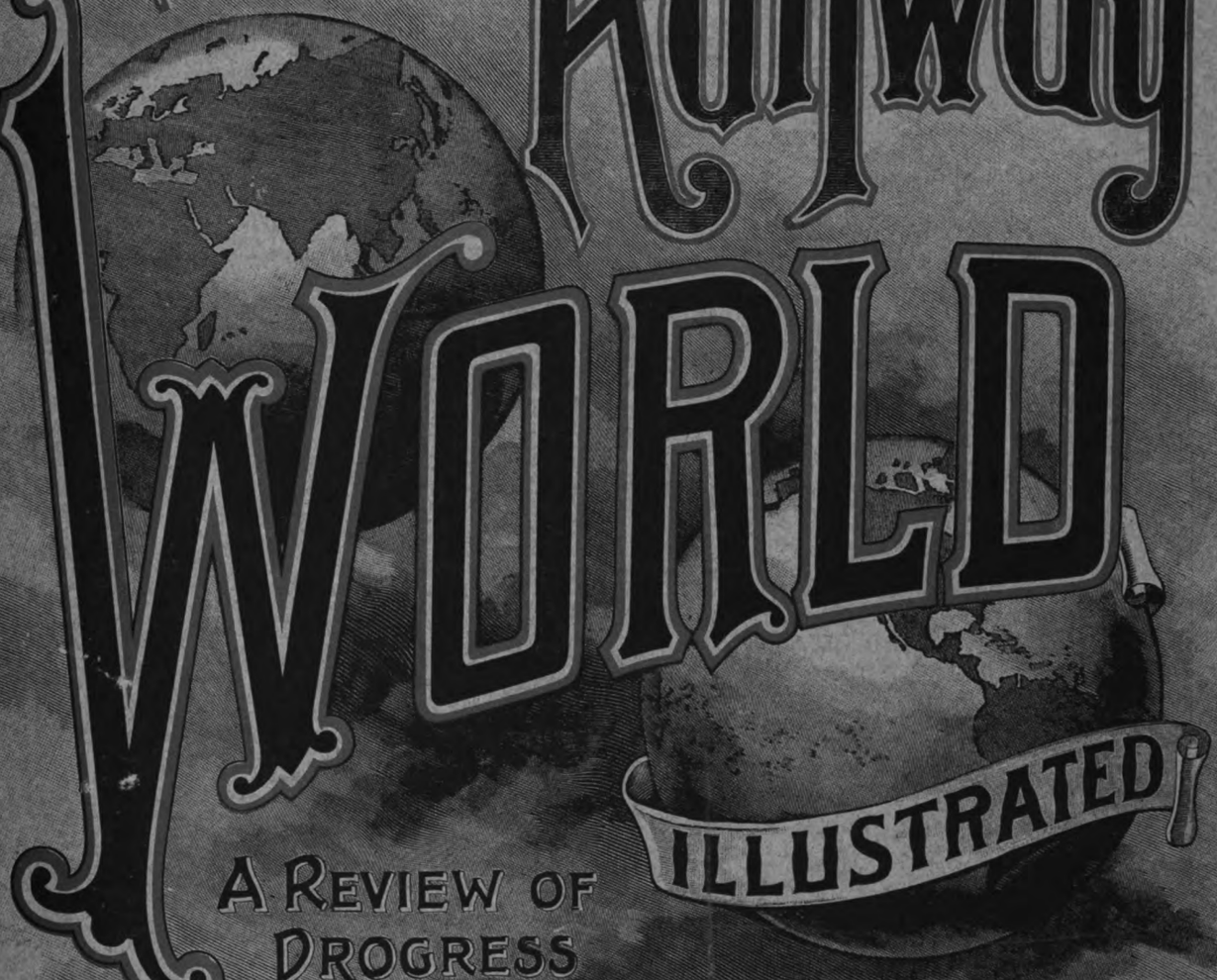

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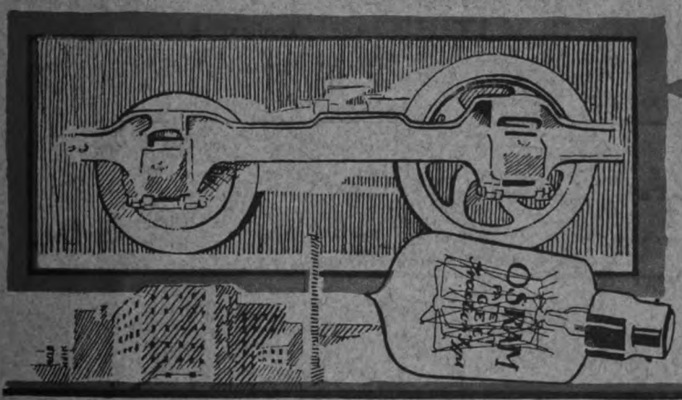

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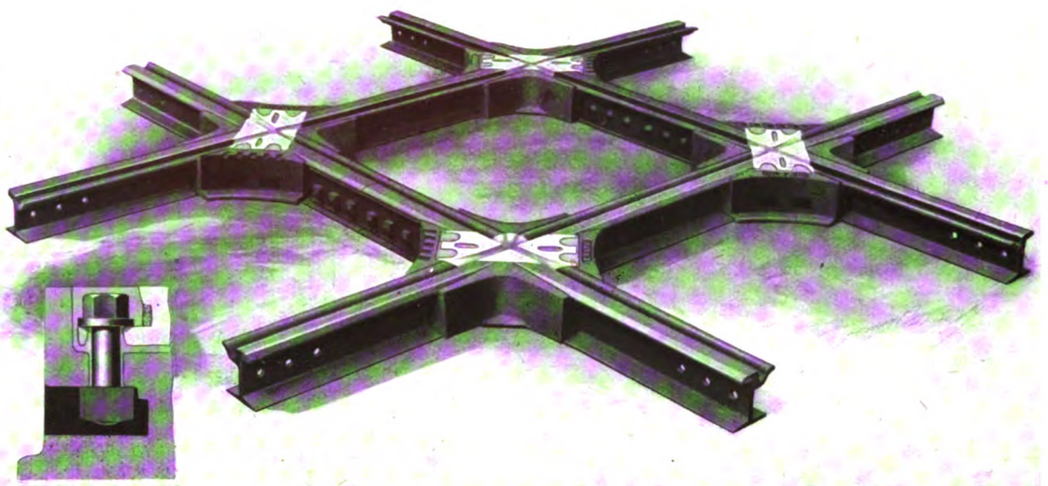

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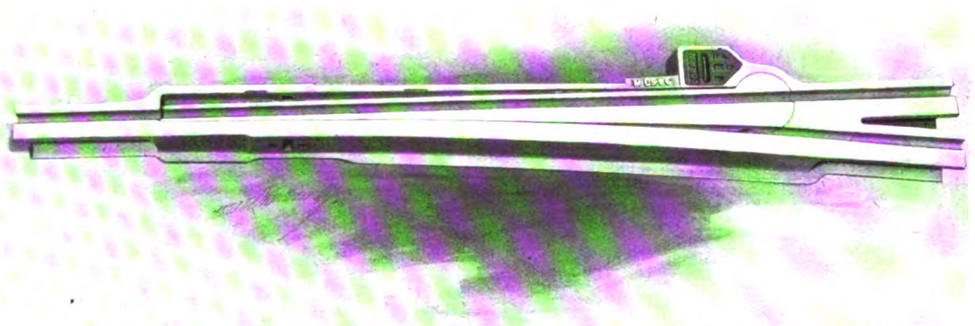

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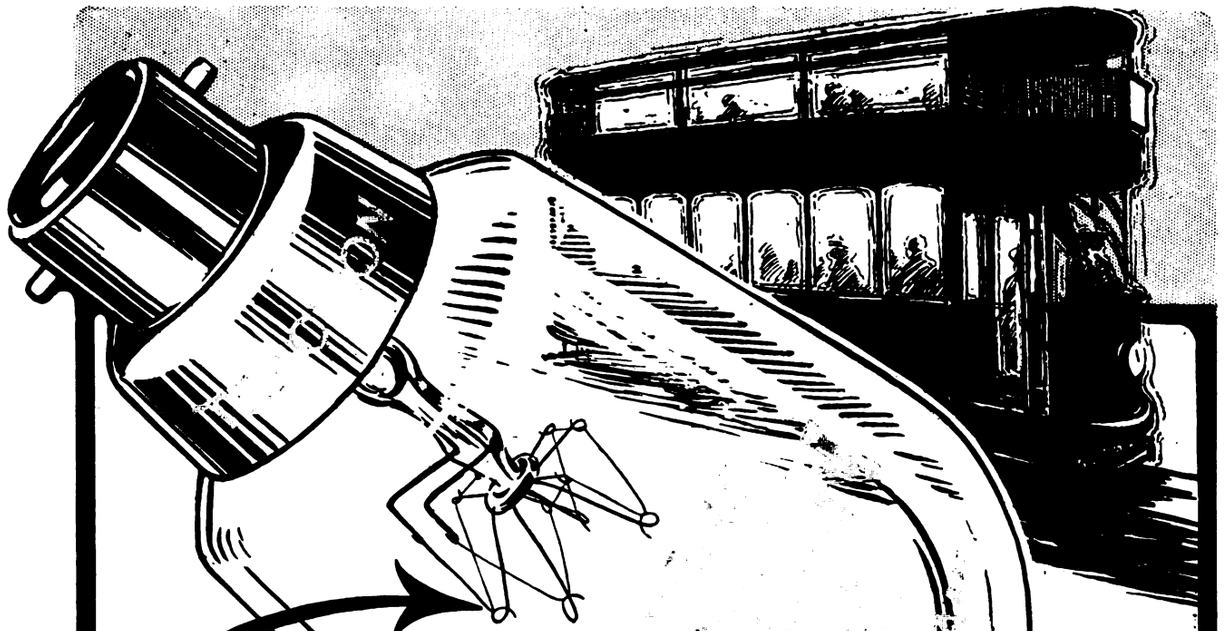

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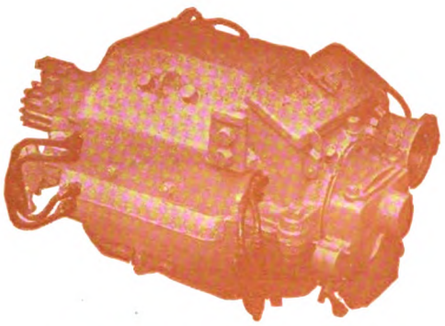

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View from commutator end.

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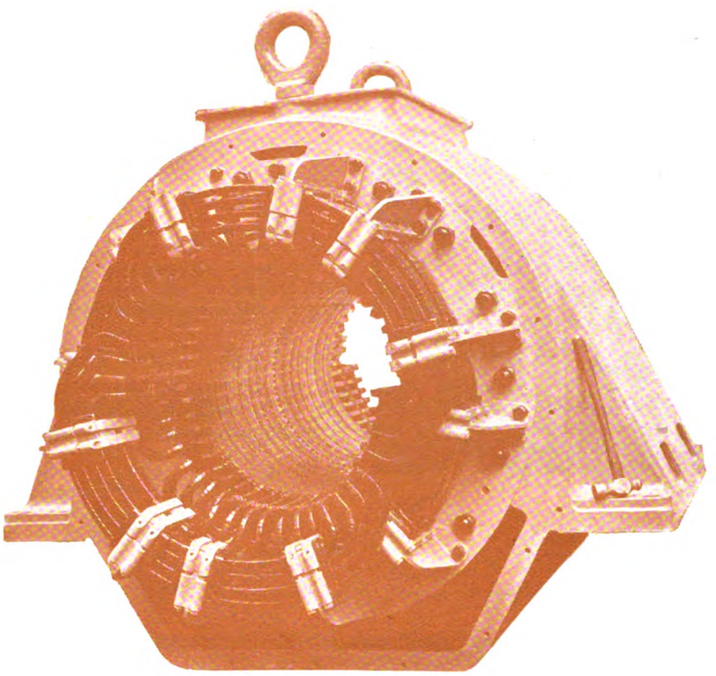

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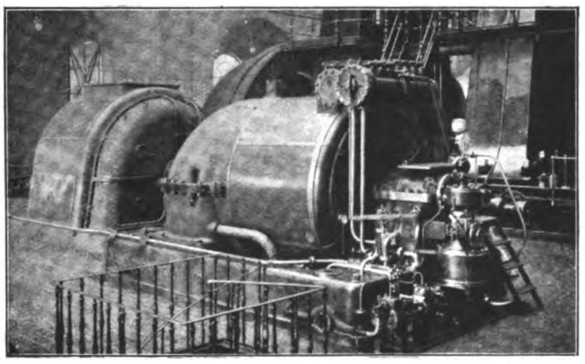

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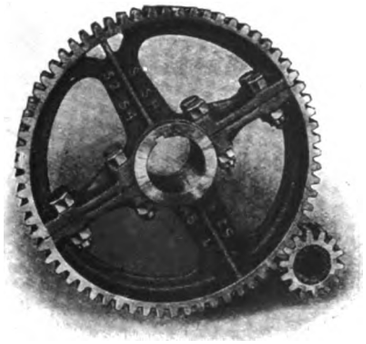

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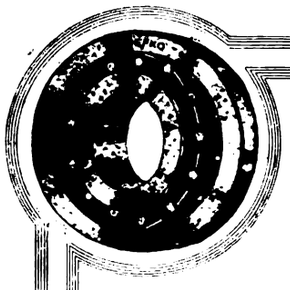

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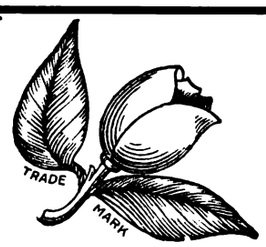

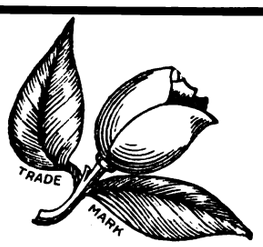

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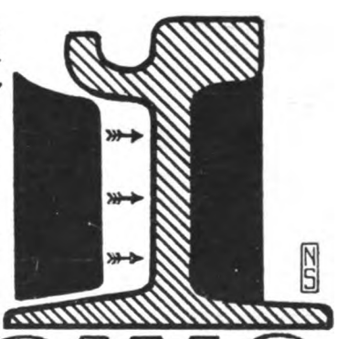

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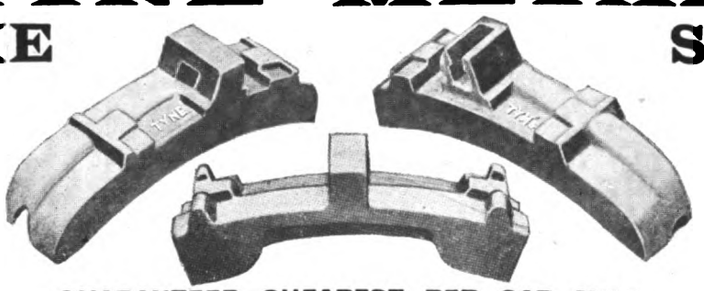

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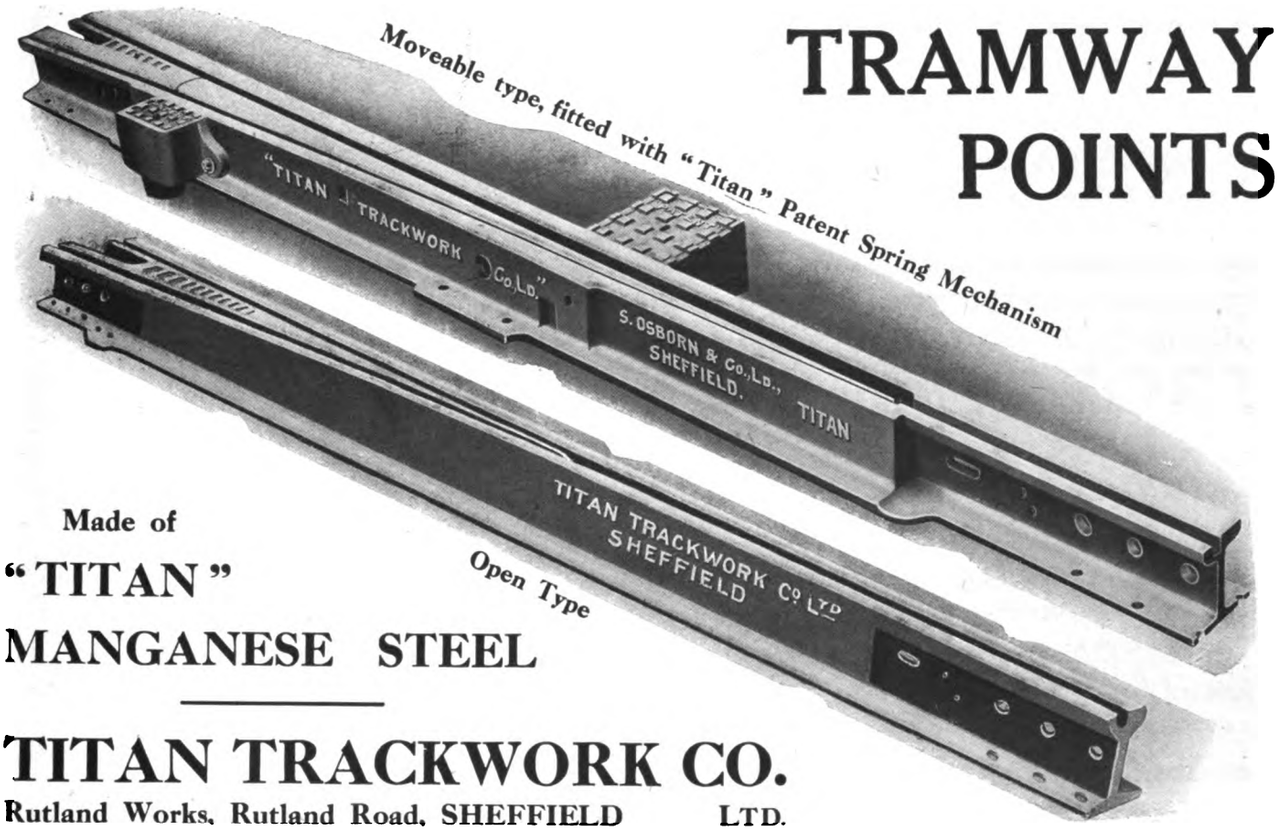
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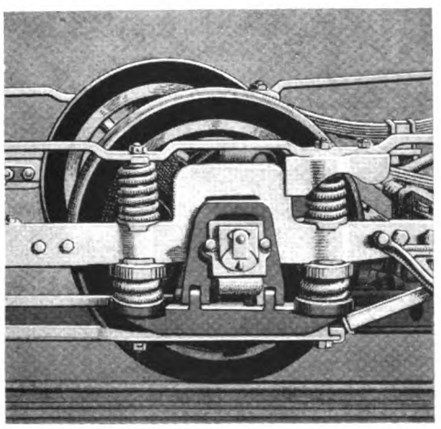

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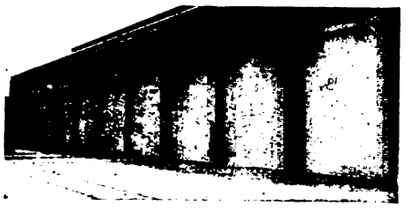

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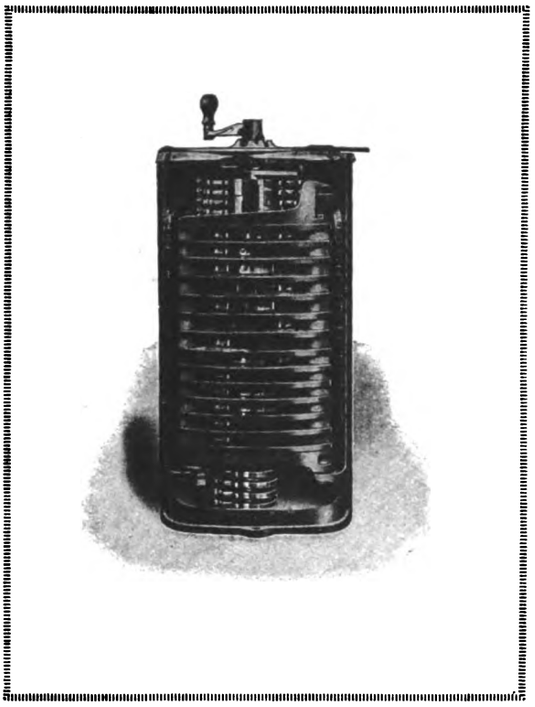

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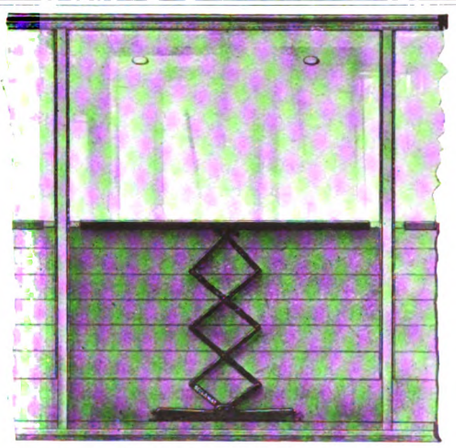

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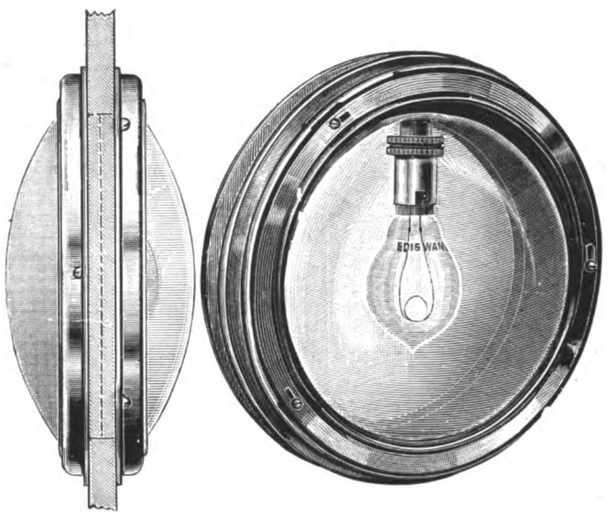

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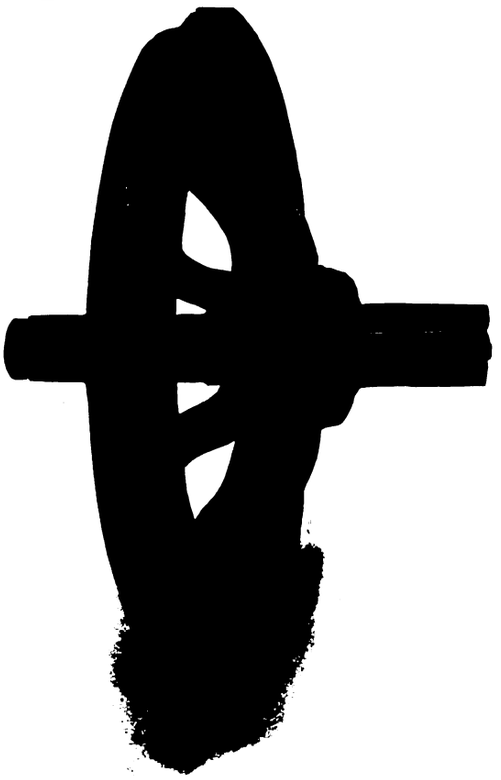

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NAMES OF PRINCIPAL OFFICERS,

POSTAL ADDRESS, TELEGRAPHIC ADDRESS, AND TELEPHONE NUMBERS.

MUNICIPAL TRAMWAYS, pp. xxiii-xxiv. COMPANY TRAMWAYS, pp. xxiv-xxvi. PARTICULARS OF TRACK AND EQUIPMENT, pp. xxvii-xxx.

TRAMWAY ASSOCIATIONS, p. xxvi.

Aberdare Urban District Tramways, Gadlys Estate, Aberdare. [T.A., Tramways, Aberdare; T.N., 17.] *Gen. Manager and Elec. Engineer*, A. J. Abraham; *Traffic Supt.*, H. King; *Chairman Try. Com.*, Coun. E. Stonelake.

Aberdeen Corporation Tramways, Municipal Buildings, Union Street, Aberdeen. [T.A., Trams, Aberdeen; T.N. 826.] *Gen. Manager and Eng.*, R. S. Pilcher; *Per. Way Eng.*, J. Gordon (*Burgh Surveyor*); *Chairman Try. Com.*, Coun. Robertson.

Accrington Corporation Tramways, Market Hall, Accrington. [T.A., Trams, Accrington; T.N., 2212.] *Gen. Manager and Eng.*, H. Pilling; *Per. Way Eng.*, W. J. Newton; *Chairman Try. Com.*, Ald. T. E. Higham; *Vice-Chairman*, Coun. Morley.

Ashton-under-Lyne Corporation Tramways, Tramway Depot, Mossley Road, Ashton. [T.A., Tramways, Ashton; T.N., 325.] *Gen. Manager*, Ernest Holt; *Elec. Eng.*, N. Appelbee; *Chairman Try. Com.*, Ald. R. S. Oldham; *Vice-Chairman*, Ald. Waterhouse.

Ayr Corporation Tramways, Town Building, Ayr. [T.A., Trams, Ayr; T.N., 123.] *Gen. Manager and Eng.*, William Grant; *Burgh Elec. Eng.*, R. Marshall; *Per. Way Eng.*, John Young; *Rolling Stock Supt.*, Alf. Somerville; *Convener Try. Com.*, Coun. J. R. Learmont; *Vice-Chairman*, Bailie Murray.

Bacup Corporation Tramways.—Town Hall, Bacup, Lancs. [Lines leased to and worked by Rochdale Corporation.] *Town Clerk*, J. Entwistle; *Boro' Eng.*, W. H. Elce; *Chairman Try. Com.*, Ald. Sir H. Maden (Mayor); *Vice-Chairman*, Coun. J. H. Lord.

Barking Town Urban District Tramways, East Street, Barking. [T.N., 156 East Ham.] *Eng. and Manager*, W. Holmes; *Acting Engineer and Manager*, W. E. Kidner; *Chairman Try. Com.*, Coun. D. Gordon.

Barton-upon-Irwell District Council Light Railways, Barton-upon-Irwell.

[Line leased to and worked by the Lancashire United Tramways Co., *q.v.*]

Batley Corporation Tramways, Batley, Yorks. *Engineer*, S. D. Jones; *Chairman Try. Com.*, Coun. F. W. H. Auty; *Vice-Chairman*, Coun. J. E. Oldroyd.

[Lines leased to and worked by the Yorkshire (Woollen District) Electric Tramways, Ltd., *q.v.*]

Belfast City Tramways, Tramways Office, Sandy Row, Belfast. [T.A., Nance, Tramway, Belfast; T.N., 2444.] *Gen. Manager*, J. S. D. Moffet; *Traffic Manager*, R. McMaster; *City Elec. Eng.*, T. W. Bloxam; *Per. Way Eng.*, E. S. Pinkerton; *Chief Eng.*, A. A. Blackburn; *Chairman Try. Com.*, Ald. J. Tyrell, J.P.; *Vice-Chairman*, Coun. J. C. White.

Bexley Urban District Council Tramways, Car Sheds, Bexleyheath, Kent. [T.A., Stokes, Tramways, Bexleyheath; T.N., 79.] *Gen. Manager and Elec. Eng.*, H. P. Stokes; *Rolling Stock Supt.*, A. Williams; *Chairman Try. Com.*, Coun. G. Sheldon.

Birkenhead Corporation Tramways, Laird Street, Birkenhead. [T.A., Tramways Manager, Birkenhead; T.N., 1110.] *Gen. Manager*, C. Clarke; *Borough Sur. and Eng.*, C. Brownridge; *Rolling Stock Supt.*, R. Chadwick; *Chairman Try. Com.*, Coun. H. Halsall; *Vice-Chairman*, Coun. R. Frame.

Birmingham Corporation Tramways, The Council House, Congreve Street, Birmingham. [T.A., Trams, Birmingham; T.N., Central 7,000.] *Gen. Manager*, A. Baker; *City Elec. Eng.*, R. A. Chattock; *Traffic Supt.*, J. McDonnell; *Per. Way Eng.*, C. E. S. Bill; *Rolling Stock Supt.*, R. H. Dickinson; *Chairman Try. Com.*, Coun. H. Barrow, J.P.; *Vice-Chairman*, Coun. Fryer.

Blackburn Corporation Tramways, Tramways Office, Blackburn. [T.A., Tramways, Blackburn; T.N., 547.] *General Manager*, J. H. Cowell; *Elec. Eng.*, P. P. Wheelwright; *Traffic Manager*, E. Greek; *Car Shed Supt.*, H. W. Seymour; *Chairman Try. Com.*, Ald. W. Thompson; *Vice-Chairman*, Coun. C. Higham.

Blackpool Corporation Tramways, West Caroline Street, Blackpool. [T.N., 67.] *Gen. Manager*, C. Furness; *Traffic Supt.*, C. J. Baker; *Resident Eng.*, F. Field; *Chairman Try. Com.*, Richard Holt, J.P.; *Vice-Chairman*, Coun. R. Holt (Deputy Mayor).

Bolton Corporation Tramways, Bradshawgate, Bolton. [T.A., Manager, Tramways. Bolton; T.N., 490.] *General Manager*, J. Barnard; *Elec. Eng.*, W. J. H. Wood; *Per. Way Eng.*, E. Ll. Morgan; *Rolling Stock Supt.*, C. Beech; *Chairman Try. Com.*, Ald. J. Miles; *Vice-Chairman*, Coun. P. Higson.

Bootle Corporation Tramways, Electricity Works, Pine Grove, Bootle. [T.N., 424.] *Elec. Eng.*, T. D. Clothier; *Chairman Try. Com.*, Ald. Booth; *Vice-Chairman*, Coun. Pennington.

[Lines worked by Liverpool Corporation Tramways.]

Bournemouth Corporation Tramways, Tramways Offices, Lansdowne Crescent, Bournemouth [T.A., Tramways, Bournemouth; T.N., 1701.] *General Manager*, I. Bulfin; *Chief Assistant & Elec. Eng.*, H. Vickers; *Traffic Supt.*, R. O. Baldwin; *Chairman Try. Com.*, Coun. Bell; *Vice-Chairman*, Coun. McCabe.

Bradford Corporation Tramways, Central Office, 7, Hall Ings, Bradford. [T.A., Tramways, Bradford; T.N., 2381 and 2382.] *Gen. Manager*, C. J. Spencer; *Asst. Elec. Eng.*, J. W. Dawson; *Traffic Supt.*, T. Stirk; *City Elec. Eng.*, T. Roles; *Chairman Try. Com.*, Coun. Enoch Priestley; *Vice-Chairman*, Coun. J. F. Akeroyd.

Brighton Corporation Tramways, Lewes Road, Brighton. [T.A., Tramways, Brighton; T.N., 353 P.O.] *Eng. & Manager*, William Marsh; *Traffic Supt.*, W. N. Brooks; *Rolling Stock Supt.*, W. Orchard; *Per. Way Eng.*, F. N. Hudson; *Chairman Try. Com.*, Coun. Martin.

Burnley Corporation Tramways, Queen's Gate, Burnley. [T.N., 46.] *Gen. Manager*, Henry Mozley; *Boro. Elec. Eng.*, J. E. Starkie; *Boro. Surveyor*, G. H. Pickles; *Chairman Try. Com.*, Coun. E. Heap; *Vice-Chairman*, Coun. Irving.

Burton-on-Trent Corporation Tramways, Guild Street, Burton-on-Trent. [T.N., 202.] *Manager*, A. B. Slater; *Engineer*, T. Hall; *Chairman Try. Com.*, Ald. J. S. Rowland (Deputy Mayor); *Vice-Chairman*, Ald. Metcalfe.

Bury Corporation Tramways, Market Place, Bury. [T.N., 26.] *Gen. Manager*, William Clough; *Boro. Elec. Eng.*, S. J. Watson; *Chairman Try. Com.*, Ald. T. S. Collinge; *Vice-Chairman*, Coun. Hargreaves.

Cardiff Corporation Tramways, Central Offices, The Hayes, Cardiff. [T.A., Tramways, Cardiff; T.N., 1211, 1240, 1350, and 377.] *Gen. Manager and Elec. Eng.*, A. Ellis; *Deputy Manager*, C. G. M. New; *Traffic Manager*, H. David; *Per. Way Eng.*, W. Harpur; *Rolling Stock Supt.*, Jas. Preston; *Chairman Try. Com.*, Ald. Sir J. W. Courtis, J.P. (Deputy Mayor); *Vice-Chairman*, Coun. A. J. A. Stone.

Chester Corporation Tramways, Station Road, Chester. [T.N., 166.] *Traffic Supt.*, W. H. Ellis; *Elec. Eng.*, S. E. Britton; *Per. Way Eng.*, W. M. Jones; *Chairman Try. Com.*, Ald. J. Jones; *Vice-Chairman*, Coun. A. S. Dutton.

Chesterfield Corporation Tramways, Chatsworth Road, Chesterfield. [T.A., Tramways, Chesterfield; T.N., 78.] *Gen. Manager and Elec. Eng.*, R. L. Acland; *Traffic Manager*, F. Root; *Per. Way Eng.*, C. E. Crossley; *Chairman Try. Com.*, Ald. E. Shentall (Mayor); *Vice-Chairman*, Coun. Woodhead.

Colchester Corporation Tramways, Magdalen Street, Colchester. [T.A., Tramways, Colchester; T.N., 92.] *Gen. Manager and Engineer*, R. C. Bullough; *Chairman Try. Com.*, Coun. A. M. Jarmin; *Vice-Chairman*, Coun. J. T. Bailey.

Colne Corporation Tramways, Colne, Lancashire. *General Manager and Engineer*, T. G. Richardson; *Chairman Try. Com.*, Coun. R. Knight (Mayor).

Coventry Corporation Tramways, Priestley's Bridge, Coventry. [T.A., Tramways, Coventry; T.N., 1014.] *Engineer and General Manager*, T. R. Whitehead; *Assistant Engineer*, W. M. Milnes; *Chairman*, Coun. C. V. Pugh; *Vice-Chairman*, Coun. H. W. Wale.

Croydon Corporation Tramways, Tramways Office, Thornton Heath, Surrey. [T.A., Tramways, Croydon; T.N., 406, Croydon.] *Tramways Manager*, T. B. Goodyer; *Chairman Try. Com.*, Ald. G. J. Allen; *Vice-Chairman*, Coun. A. A. Thomson.

Darlington Corporation Tramways, Haughton Road, Darlington. [T.A., Tramways, Darlington; T.N., 2435.] *General Manager and Elec. Eng.*, J. R. P. Lunn; *Traffic Supt.*, J. Fraser; *Chairman Try. Com.*, Ald. C. W. Starmer.

Dartford Urban District Council Tramways, Dartford. *Chairman Try. Com.*, Coun. R. Bennett; *Vice-Chairman*, Coun. W. H. D. King.

[Leased. See Dartford Tramways in list of Tramway Companies.]

Darwen Corporation Tramways, Lorne Street, Darwen. [T.N., 104.] *Gen. Manager and Eng.*, F. J. S. Hosken; *Boro. Elec. Eng.*, C. H. Garnett; *Chairman Try. Com.*, Ald. Jas. Tomlinson.

Derby Corporation Tramways, 4, Victoria Street, Derby. [T.N., 410.] *Gen. Manager*, F. Harding; *Elec. Eng.*, T. P. Wilmshurst; *Per. Way Eng.*, J. Ward; *Chairman Try. Com.*, Coun. J. Dean.

Doncaster Corporation Tramways, Grey Friar's Road, Doncaster. [T.A., Rayner, Doncaster, T.N., 43.] *Manager & Elec. Eng.*, E. S. Rayner; *Chairman Try. Com.*, Coun. S. Balmforth; *Vice-Chairman*, Coun. H. M. Marshall.

Dover Corporation Tramways, Town Hall, Dover. [T.A., Trams, Dover; T.N., 294.] *Gen. Manager*, E. Carden; *Per. Way Eng.*, W. C. Hawke (Boro. Surveyor); *Chairman Try. Com.*, Coun. Barwick; *Vice-Chairman*, Coun. Norman.

Dundee Corporation Tramways, Town House Buildings, Dundee. [T.N., 1340]; *Gen. Manager and Eng.*, Peter Fisher; *Elec. Eng.*, H. Richardson; *City Eng.*, J. Thomson; *Chairman Try. Com.*, ——

East Ham (County Borough of) Corporation Tramways, Nelson Street, East Ham. [T.N., 611 and 100, East Ham.] *Gen. Manager and Elec. Eng.*, W. C. Ullmann; *Chairman Try. Com.*, Ald. M. Oakes.

Eccles Corporation Tramways, Eccles. *Elec. Eng.*, H. W. Angus; *Per. Way Eng.*, T. S. Picton; *Chairman Try. Com.*, Coun. Alexander; *Vice-Chairman*, Ald. Pearson.

[Lines worked by Salford Corporation.]

Erith Urban District Council Tramways, Tramway Depôt, Walnut Tree Road, Erith. [T.A., Tramways, Erith; T.N., 36.] *Gen. Manager and Elec. Engineer*, J. C. Williams; *Chairman Try. Com.*, Coun. G. C. Humphreys.

Exeter Corporation Tramways, Paris Street, Exeter. *Manager*, H. C. Bartlett; *Elec. Eng.* H. D. Munro; *Per. Way Eng.*, T. Moulding; *Chairman Try. Com.*, Ald. H. B. Varwell; *Vice-Chairman*, Coun. F. G. Towill.

Farnworth Urban District Council Tramways, Albert Road, Farnworth. *Chairman Try. Com.*, Coun. S. C. Steele; *Vice-Chairman*, Coun. Stanley.

[Lines leased to the South Lancashire Tramways Co.]

Glasgow Corporation Tramways, 46, Bath Street, Glasgow. [T.A., Trams, Glasgow; T.N., 1040, Douglas.] *Gen. Manager*, J. Dalrymple; *Traffic Supt.*, L. Mackinnon; *Chief Eng.*, J. Ferguson; *Elec. Eng.*, E. T. Goslin; *Sec.*, J. N. Wilson; *Chairman Try. Com.*, Coun. Montgomery; *Vice-Chairman*, Bailie Kelly.

Gloucester Corporation Light Railway, Bristol Road Depôt, Gloucester. [T.A., Tramways, Gloucester; T.N. 155.] *Gen. Manager and Elec. Eng.*, F. H. Corson; *Chairman Try. Com.*, Coun. J. O. Roberts; *Vice-Chairman*, Coun. C. J. Ramstedt.

Great Yarmouth Corporation Tramways, Caister Road, Great Yarmouth. [T.N. 265.] *Gen. Manager*, F. L. Turner; *Elec. Eng.*, Gordon Bryant; *Per. Way. Eng.*, J. W. Cockrill (Borough Surveyor); *Chairman Try. Com.*, Coun. J. T. C. Salmon.

Halifax Corporation Tramways, Skircoat Road, Halifax. [T.N., 36 and 382.] *Traffic Manager*, Jas. D. Caird; *Try. Eng.*, J. W. Galloway; *Per. Way Eng.*, J. Lord (Boro. Eng.); *Chairman Try. Com.*, Ald. C. F. Spencer; *Vice-Chairman*, Ald. A. Fawcett.

Haslingden Corporation Tramways, John Street, Haslingden. *Gen. Manager and Elec. Eng.*, Barnes Kay; *Per. Way Eng.*, J. S. Green (Borough Surveyor); *Chairman Try. Com.*, Coun. Waddington; *Vice-Chairman*, Coun. Haworth.

Herne Bay Pier Tramway (owned and worked by Herne Bay U.D.C.), Herne Bay. [T.N., 22.] *Res. Eng. and Manager*, H. C. Dutton.

Heywood Corporation Tramways, Heywood, Lancs. [T.N., 47.] *Gen. Manager*, D. H. Davies; *Per. Wa Eng.*, J. B. Nuttall; *Chairman Try. Com.*, Coun. J. Ashworth; *Vice-Chairman*, Ald. T. Popple, J.P.

Huddersfield Corporation Tramways, Northumberland Street, Huddersfield. [T.N., 698 and 398.] *Gen. Manager & Elec. Eng.*, R. H. Wilkinson; *Assist. Engineer*, A. P. Quilliam; *Traffic Supt.*, T. Hartley; *Borough Eng.*, K. F. Campbell; *Chairman Try. Com.*, Coun. F. H. Sellers; *Vice-Chairman*, Coun. T. Canby.

Hull Corporation Tramways, Alfred Gelder Street, Hull. [T.N., 444, Corporation.] *Manager*, Wm. J. McCombe; *Try. Elec. Eng.*, J. Wilkinson [T.N. 443, Corporation]; *Per. Way Eng.*, F. W. Bricknell (*City Engineer*) [T.N. 943, Corporation]; *Chairman Try. Com.*, ——; *Vice-Chairman*, Coun. Hakes.

Ilford Urban District Council Tramways, Ley Street, Ilford. [T.N., 684.] *Manager and Engineer*, L. E. Harvey; *Chairman Try. Com.*, Coun. O. Waters; *Vice-Chairman*, Coun. J. Lowe.

Ilkeston Corporation Tramways, Park Road, Ilkeston. [T.A., Bellamy Ilkeston; T.N., 26.] *Manager and Elec. Eng.*, L. C. F. Bellamy; *Chairman Try. Com.*, Coun. J. E. Bestwick; *Vice-Chairman*, Coun. Kane.

[These tramways have been sold to the Tramways Light and Power Co., Ltd.]

Ipswich Corporation Tramways, Constantine Road, Ipswich. [T.A., Ayton, Tramways, Ipswich; T.N., 354.] *Gen. Manager and Elec. Eng.*, Frank Ayton; *Traffic Supt.*, A. Butler; *Rolling Stock Supt.*, W. A. Fairhead; *Chairman Try. Com.*, Coun. E. C. Ransome; *Vice-Chairman*, W. P. Burton.

Kearsley Urban District Council Tramways, Council Office, Kearsley, Farnworth, S.O. *Clerk U. D. C.*, H. Martin.

[Lines leased to and worked by the South Lancashire Tramways Co.]

Keighley Corporation Tramways, South Street, Keighley. [T.A., Tramways, Keighley; T.N., 17.] *Gen. Manager and Elec. Eng.*, H. Webber; *Chairman Try. Com.*, Coun. A. Smith.

Kilmarnock Corporation Tramways Electricity Works, Kilmarnock. [T.N., 95.] *Elec. Eng. and Manager*, W. C. Bexon; *Consulting Engineers*, Kennedy and Jenkin; *Convener Try. Com.*, Coun. Lorimer.

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Kirkcaldy Corporation Tramways, Electricity Works Victoria Road, Kirkcaldy. [T.A., Tramways, Kirkcaldy. T.N., 124, 174, and 175.] *Manager & Elec. Eng.*, O. F. Francis; *Traffic Manager*, Jas. Fisher; *Chairman Try. Com.*, Coun. G. Fergusson.

Lancaster Corporation Tramways, Electricity Works, Lancaster. [T.A., Milnes, Tramways, Lancaster; T.N., 1, L.] *Gen. Manager & Elec. Eng.*, G. C. Milnes; *Acting Boro. Electrical Engineer and Tramways Manager*, J. B. Patterson; *Traffic Manager*, W. T. Charlton; *Chairman Try. Com.*, Coun. T. Wilkinson.

Leeds City Tramways, Swinegate, Leeds. [T.A., Tramways, Leeds; T.N., 1230; *General Manager*, J. B. Hamilton; *Traffic Supt.*, A. Daggett; *Elec. Eng.*, John Burbridge; *Highways and Per. Way Eng.*, R. B. Holt; *Car Works Supt.*, G. E. Watmough; *Chairman Try. Com.*, Ald. R. A. Smithson; *Vice-Chairman*, Ald. H. Brown.

Leicester Corporation Tramways, 20 and 22, Humberstone Gate, Leicester. [T.N., 2177.] *Manager & Sec.*, A. F. Lucas; *Boro. & Try. Eng.*, E. G. Mawbey; *Boro. Elec. Eng.*, T. R. Smith; *Cons. Engs.*, Kincaid, Waller & Manville; *Chairman Try. Com.*, Ald. S. Flint, J.P.; *Vice-Chairman*, Ald. G. Banton, J.P.

Leith Corporation Tramways, 165, Leith Walk, Leith. [T.N., 415.] *Gen. Manager*, F. A. Fitzpayne; *Per. Way Eng.*, J. R. Findlay (*Burgh Eng.*); *Chairman Try. Com.*, Judge Hall.

Leyton District Council Tramways, Car Depot, Lea Bridge Road, Leyton, E. [T.A., Tramways, Leyton; T.N., 17 Walthamstow.] *Manager*, F. Schofield; *Elec. Eng.*, F. Harman Lewis; *Per. Way Eng.*, E. H. Essex; *Chairman Try. Com.*, Coun. F. M. Read.

Lincoln Corporation Tramways, Brayford Side North, Lincoln. [T.A., Stanley Clegg, Lincoln; T.N., 109]. *General Manager and Elec. Eng.*, Stanley Clegg; *Chairman Try. Com.*, Ald. W. S. White; *Vice-Chairman*, Coun. M. A. Ashley.

Liverpool Corporation Tramways, 24, Hatton Garden, Liverpool. [T.A., Tramways, Liverpool; T.N., 6054 and 7701, Central.] *General Manager*, C. W. Mallins; *Per. Way Eng.*, J. A. Brodie (*City Engineer*); *City Electrical Engineer*, Harold Dickinson; *Rolling Stock Supt.*, T. Ridyard; *Chairman Try. Com.*, Coun. E. Russell Taylor; *Vice-Chairman*, Ald. F. Smith, J.P.

London County Council Tramways, 62, Finsbury Pavement, London, E.C. [T.A., Lotram Ave., London; T.N., 3321, 3322, and 3328 London Wall.] *General Manager*, A. L. C. Fell; *Traffic Manager*, J. K. Bruce; *Electrical Engineer*, P. L. Riviere; *Rolling Stock Supt.*, W. E. Ireland; *Per. Way Eng.*, J. Welling; *Chairman Highways Com.*, G. H. Hume; *Vice-Chairman*, A. H. Scott, J.P.

Lowestoft Corporation Tramways, Norwich Road, Lowestoft. [T.N., 87.] *Gen. Manager*, H. H. Saunders; *Elec. Eng.*, W. R. May; *Chairman Try. Com.*, Coun. F. Spashett (Mayor).

Maidstone Corporation Tramways, Tramway Offices, Tonbridge Road, Maidstone. [T.A., Lambert, Tramways, Maidstone; T.N., 448] *Gen. Manager and Elec. Eng.*, A. T. Lambert; *Chairman Try. Com.*, Ald. D. T. J. Lyle; *Vice-Chairman*, Coun. Green.

Manchester Corporation Tramways, 55, Piccadilly, Manchester. [T.A., Tramways, Manchester; T.N., 7800 City.] *Gen. Manager*, J. M. McElroy; *Traffic Sup.*, J. T. Oakes; *Elec. Eng.*, J. J. McMahon; *Chief Civil Eng.*, H. Mattinson; *Rolling Stock Supt.*, G. R. Blackburn; *Chairman Try. Com.*, Ald. J. Bowes; *Vice-Chairman*, Ald. A. W. Chapman.

Middlesex County Council Light Railways, Middlesex Guildhall, Westminster, London, S.W. *County Eng.*, H. T. Wakelam, M.I.C.E.; *Chairman of Light Railways Com.*, County Ald. H. Burt; *Vice-Chairman*, County Coun. F. Goodyear.

Middleton Corporation Tramways. *Consulting Engs.*, Lacey, Sillar, and Leigh; *Chairman Try. Com.*, Ald. W. Wood, J.P. (Mayor); *Vice-Chairman*, Ald. Bentley, J.P.
[Worked by Manchester Corporation Tramways.]

Nelson Corporation Light Railways, Charles Street, Nelson. [T.N., 115.] *Manager and Elec. Eng.*, G. F. Nayler; *Per. Way Eng.*, W. Shackleton; *Chairman Try. Com.*, Coun. W. F. Cooke.

Newcastle-upon-Tyne Corporation Tramways, Manors, Newcastle. [T.A., Traction, Newcastle; T.N., 913 and 914 Central.] *Gen. Manager & Engineer*, Ernest Hatton; *Traffic Supt.*, T. Chalder; *Per. Way Eng.*, W. J. Steele; *Chairman Try. Com.*, Coun. R. Mayne; *Vice-Chairman*, Coun. A. M. Sutherland.

Newport (Mon.) Corporation Tramways, Town Hall, Newport, Mon. [T.A., Dynamo, Newport, Mon.; T.N., 990 L., Nat.] *Gen. Manager*, N. J. Young; *Boro. Elec. and Per. Way Eng.*, A. Nichols Moore; *Chairman Try. Com.*, Coun. J. Moxon; *Vice-Chairman*, Coun. F. Phillips.

Northampton Corporation Tramways. St. James', Northampton. [T.N., 279 & 280.] *Gen. Manager and Elec. Eng.*, J. F. Cameron; *Chairman Try. Com.*, Coun. T. D. Lewis; *Vice-Chairman*, Coun. W. Beale.

Nottingham Corporation Tramways, Beastmarket Hill, Nottingham. [Tramways, Nottingham; T.N., 225.] *General Manager & Elec. Eng.*, John Aldworth; *Traffic Supt.*, H. Morley; *Per. Way Eng.*, Arthur Brown (*City Eng.*); *Rolling Stock Supt.*, W. Boot; *Chairman Try. Com.*, Coun. R. H. Swain, J.P.; *Vice-Chairman*, Ald. F. R. Radford, J.P.

Oldham Corporation Tramways, Wallshaw Depot, Oldham. [T.A., Tramways, Oldham; T.N., 1495.] *Gen. Manager & Eng.*, P. Priestly; *Traffic Supt.*, J. Brierley; *Chairman Try. Com.*, Coun. Cheetham; *Vice-Chairman*, Coun. Stanbury.

Perth Corporation Tramways, 128, High Street, Perth. [T.N., 226 & 101.] *Tramways Manager*, W. G. Snell; *Elec. & Tramways Eng.*, John Lambert; *Per. Way Eng.*, R. McKillop (*Burgh Surv.*); *Chairman Try. Com.*, Coun. Calderwood.

Plymouth Corporation Tramways, 15, Ebrington Street, Plymouth. [T.N. 518, Plymouth.] *General Manager*, C. R. Everson; *Elec. Eng.*, E. J. Okell; *Chairman Try. Com.*, Ald. S. H. Phillips, J.P.; *Vice-Chairman*, Coun. J. Moon.

Pontypridd Urban District Tramways, Generating Station, Treforest, Pontypridd. [T.N. 33.] *Gen. Manager and Elec. Eng.*, J. E. Teasdel; *Traffic Inspector*, W. May; *Per. Way Eng.*, W. E. Lowe (*Surveyor*); *Chairman Try. Com.*, Coun. M. L. Jones.

Portsmouth Corporation Tramways, Town Hall, Portsmouth. [T.N., 110 Corporation.] *Gen. Manager*, W. R. Spaven; *Elec. and Per. Way Eng., and Rolling Stock Supt.*, V. G. Lironi; *Traffic Supt.*, W. Munford; *Chairman Try. Com.*, Coun. J. Timpson; *Vice-Chairman*, Ald. R. Payne.

Preston Corporation Tramways, Holmrook Road, Preston. [T.A., Corporation Tramways, Preston; T.N., 273.] *Gen. Manager and Elec. Eng.*, J. F. Simpson; *Traffic Supt.*, C. H. Manning; *Chairman, Try. Com.*, Ald. J. Ormrod; *Vice-Chairman*, Coun. T. Parkinson.

Radcliffe Urban District Council Tramways, Council Offices, Radcliffe, Lancs. *Res. Eng.*, H. Wilkinson; *Per. Way Eng.*, W. L. Rothwell; *Clerk*, S. Mills; *Chairman Try. Com.*, Coun. Walker Allen, J.P.
[These tramways are worked as part of the Bury system.]

Rawtenstall Corporation Tramways, Bacup Road, Rawtenstall. [T.N., 81 and 85.] *Gen. Manager and Elec. Eng.*, C. L. E. Stewart; *Chairman Try. Com.*, Ald. H. Coupe, J.P.; *Vice-Chairman*, Coun. J. W. Stansfield.

Reading Corporation Tramways, Mill Lane, Reading. [T.A., Tramways Manager, Reading; T.N., 330.] *Gen. Manager & Elec. Eng.*, G. F. Craven; *Chairman Try. Com.*, Ald. C. G. Field, J.P.

Rochdale Corporation Tramways, Mellor Street, Rochdale. [T.A., Tramways, Rochdale; T.N., 48.] *Gen. Manager & Eng.*, G. Webster; *Traffic Manager*, R. Bentley; *Per. Way Eng.*, S. S. Platt; *Rolling Stock Supt.*, E. Sidgwick; *Chairman Try. Com.*, Ald. Taylor.

Rotherham Corporation Tramways, Rawmarsh Road, Rotherham. [T.A., Cross, Rotherham; T.N., 138, 152, and 241.] *General Manager & Elec. Eng.*, E. Cross; *Deputy Elec. Eng.*, J. R. Lilleker; *Traffic Superintendent*, H. Jagger; *Per. Way Eng.*, T. P. Collinge; *Rolling Stock Supt.*, C. A. Walker; *Chairman Try. Com.*, Ald. D. L. Winter; *Vice-Chairman*, Coun. T. Reeves.

St. Helens Corporation Tramways, Town Hall, St. Helens, Lancs. *Chairman Try. Com.*——————; *Vice-Chairman*, Coun. W. N. Pilkington.
[Lines worked by the New St. Helens and District Tramways Co.]

Salford Corporation Tramways, 32, Blackfriars Street, Salford. [T.A., Tramways, Salford; T.N., 5367 and 5368 Central.] *Gen. Manager*, Geo. W. Holford; *Elec. Eng.*, J. A. Robertson; *Traffic Supt.*, J. W. Blakemore; *Per. Way Supt.*, E. B. Martin; *Rolling Stock Supt.*, R. Chadwick; *Chairman Try. Com.*, Ald. H. Linsley, J.P.; *Vice-Chairman*, Coun. W. H. Barrett.

Sheffield Corporation Tramways, 8, Division Street, Sheffield. [T.A., Tramways, Sheffield; T.N., 4600.] *General Manager*, A. R. Fearnley; *Traffic Supt.*, A. Handford; *Per. Way Eng.*, W. J. Hadfield; *Rolling Stock Supt.*, J. Smith; *Chairman Try. and Motors Com.*, Ald. Sir W. E. Clegg, J.P.; *Vice-Chairman*, Ald. W. C. Fenton.

Shipley Urban District Tramway, Dockfield, Shipley. [T.A., Electricity Works, Shipley; T.N., 190.] *Elec. Eng.*, Wm Redman; *Chairman Try. Com.*, H. Pitts.
[Lines leased to Bradford Corporation.]

Southampton Corporation Tramways, 161, Above Bar, Southampton. [T.A., Tramways, Southampton; T.N., 301.] *Gen. Manager*, W. T. Robson; *Boro. Elec. Engineer*, H. F. Street; *Traffic Manager*, C. G. Simpson; *Chairman Try. Com.*, Ald. F. A. Dunsford, J.P.

Southend-on-Sea Corporation Tramways, London Road, Southend-on-Sea. [T.N., 96.] *Gen. Manager and Elec. Eng.*, R. Birkett; *Traffic Manager*, J. T. Fayle; *Per. Way Eng.*, E. J. Elford (*Boro. Surveyor*); *Rolling Stock Supt.*, J. Dobson; *Chairman Try. Com.*, Coun. G. Radford.

Southend Pier Electric Railway, (owned and worked by Southend-on-Sea Corporation), [T.A., Piermaster, Southend; T.N., 91.] Southend-on-Sea. *Elec. Eng.*, C. R. Norton; *Piermaster*, Capt. N. E. Hucker; *Chairman*, Coun. H. Dowsett.

Southport Corporation Tramway, 44, Chapel Street, Southport. [T.N., 116.] *Gen. Manager*, T. J. Kendrew; *Boro' Elec. Eng.*, A. S. Black; *Chairman Try. Com.*, Ald. Griffiths, J.P.; *Vice-Chairman*, Coun. Clayton.

South Shields Corporation Tramways, Dean Road, South Shields. [T.A., Tramways, South Shields; T.N., 157.] *Gen. Manager & Elec. Eng.*, J. C. Whiteley; *Boro. Elec. Eng.*, H. S. Ellis; *Chairman Try. Com.*, Ald. W. G. Wylie.

Stalybridge Hyde, Mossley, and Dukinfield Tramways and Electricity Board, Waterloo Road, Stalybridge. [T.N., 311.] *Commercial Manager*, F. Schofield; *Chief Eng.*, R. Blackmore; *Chairman Try. Com.*, Ald. R. Wood; *Vice-Chairman*, Coun. S. C. Homer.

Stockport Corporation Tramways, Mersey Square, Stockport. [T.N., 232 and 237.] *Manager*, A. T. Eardley; *Elec. Eng.*, R. Lomax; *Chairman Try. Com.*, Ald. Chas. Sharples; *Vice-Chairman*, Ald. W. E. Hamnett.

Sunderland Corporation Tramways, Tramway Offices, Monkwearmouth, Sunderland. [T.A., Trys. Manager, Sunderland; T.N., 948.] *Gen. Manager and Elec. Eng.*, A. R. Dayson; *Chairman Try. Com.*, Coun. G. New, J.P.; *Vice-Chairman*, Coun. W. Walker, J.P.

Swindon Corporation Tramways, Electricity Works, Swindon. [T.A., Tramways, Swindon; T.N., 4.] *Manager*, T. Medcalf; *Elec. Eng.*, A. Dimmack; *Consulting Engs.*, Lacey, Sillar, & Leigh; *Chairman Try. Com.*, Coun. A. Bull; *Vice-Chairman*, Coun. Stevens.

Wallasey Corporation Tramways, Seaview Road, Wallasey. [T.A., Tramways, Liscard; T.N., 1431, Liscard.] *General Manager*, R. R. Greene; *Elec. Eng.*, J. H Crowther; *Per. Way Eng.*, W. H. Travers; *Chairman Try. Com.*, Coun. F. E. Howse; *Vice-Chairman*, Coun. H. W. Griffin.

Walsall Corporation Tramway, St. Paul's Buildings, The Bridge, Walsall. [T.A., Tramways, Walsall; T.N., 238 & 559.] *Gen. Manager*, R. L. Horsfield; *Elec. Eng.*, H. A. Howie; *Per. Way Eng.*, J. Taylor (*Boro. Surveyor*); *Chairman, Try. Com.*, Ald. J. Cope; *Vice-Chairman*, Ald. J. Williams.

Walthamstow Urban District Council Tramways, Chingford Road, Walthamstow, [T.A., Tramways, Walthamstow; T.N., 20.] *Tramways Manager*, W. Murray; *Elec. Eng.*, G. R. Spurr (Priory Avenue, Walthamstow); *Per. Way Eng.*, G. W. Holmes; *Chairman Trys. Com.*, Coun. Clarke.

Warrington Corporation Tramways, Mersey Street, Warrington. [T.N., 196] *Gen. Manager*, J. Telfer; *Elec. Eng.*, F. V. L. Mathias; *Chairman Try. Com.*, Coun. Dr. G. W. Joseph; *Vice-Chairman*, Coun. J. Wilkinson.

West Bromwich Corporation Tramway, Electricity Works, West Bromwich. [T.N., 100.] *Boro. Eng.*, A. D. Greatorex; *Boro. Elec. Eng.*, W. A. Jackson; *Chairman Try. Com.*, Ald. A. G. Turley, J.P.; *Vice-Chairman*, Coun. G. Garrett.
[These tramways are leased to the South Staffs. (Lessee) Co., Ltd.]

West Ham Corporation Tramways, Greengate Street, Plaistow, London, E. [T.A., Trameurs, Plais., London; T.N., 868 East.] *General Manager*, L. Slattery; *Boro' Elec. Eng.*, J. W. Beauchamp; *Chairman Try. Com.*, Coun. Kensett.

West Hartlepool Corporation Tramways, Cleveland Road, West Hartlepool. [T.N., 6073.] *Gen. Manager & Eng.*, Chas. Burgess; *Chairman Try. Com.*, Ald. Martin; *Vice-Chairman*, Coun. Charlton.

Wigan Corporation Tramways, Market Place, Wigan; [T.N., 226.] *Gen. Manager*, F. Buckley; *Per. Way Eng.*, A. T. Gooseman; *Chairman Try. Com.*, Ald. R. T. Fletcher; *Vice-Chairman*, Coun. J. Walkden.

Wolverhampton Corporation Tramways, Municipal Tramway Offices, Cleveland Road, Wolverhampton. [T.N., 324.] *Gen. Manager and Engineer*, C. O. Silvers; *Boro. Elec. Eng.*, S. T. Allen; *Per. Way Eng.*, George Green; *Chairman Try. Com.*, Ald. Sir C. T. Mander, Bart., J.P.; *Vice-Chairman*, Ald. S. Craddock, J.P.

York Corporation Tramways, 8, Clifford Street, York. [T.N., 302]. *Gen. Manager and Elec. Eng.*, J. W. Hame; *Traffic Supt.*, J. W. Horton; *Per. Way Eng.*, F. W. Spurr (City Surveyor); *Chairman Try. Com.*, Ald. S. W. Meyer; *Vice-Chairman*, Coun. W. H. Sessions.

COMPANY TRAMWAYS.

Aberdeen Suburban Tramways Company, 15, Golden Square, Aberdeen. [T.A., Judicial, Aberdeen; T.N., 447.] *Manager & Per. Way Eng.*, A. Wilkie; *Sec.*, G. Duncan; *Chairman*, James Mearns; *Directors*, W. Jackson, Dr. Christie, Jas. Sellar.

Airdrie and Coatbridge Tramways Company, Tramway Depôt, Main Street, Coatbridge [T.N., 105], and Electrical Federation Offices, Kingsway, London, W.C. *Gen. Manager*, A. Robertson; *Sec.*, P. N. Gray; *Chairman*, W. L. Madgen; *Directors*, H. S. Day, A. C. Miles, G. J. Somerville.

Barnsley and District Electric Traction Company, Ltd., Car Depot, Sheffield Road, Barnsley. [T.A., Tramways, Barnsley; T.N., 159.] *Acting Manager*, W. E. Nicoll; *Acting Sec.*, P. N. Gray; *Chairman*, E. Garcke; *Directors*, Col. Sir Thomas Pilkington, Bart., E. A. Paris.

Barrow-in-Furness Tramways, Salthouse Road Depot, Barrow, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Barrow; T.N., 125.] *Manager*, W. F. Bladon; *Sec.*, F. J. Cursons; *Acting Sec.*, J. S. Bowker; *Chairman*, H. S. Day; *Directors*, J. V. Kitchener, E. R. Soames.

Bath Electric Tramways Company, Ltd., Walcot Street, Bath, and 119-125, Finsbury Pavement, London, E.C. [T.A., Trams, Bath; T.N., 1214.] *Gen. Manager and Eng.*, W. E. Hardy; *Traffic Supt.*, E. Seckington; *Sec.*, H. J. Almond; *Chairman*, Hon. Sir J. Sivewright, K.C.M.G.; *Directors*, H. F. Clutterbuck, E. H. R. Trenow, A. A. C. Swinton, E. Callaird.

Bessbrook and Newry Tramway Company, Bessbrook, Co. Armagh. [T.A., Tramways, Bessbrook.] *Manager*, Robert Caven; *Elec. Eng.*, J. L. D. Meares; *Chairman*, J. N. Richardson; *Directors*, C. H. Richardson, R. T. Scott, T. W. Richardson, T. McGreggor Greer.

Birmingham District Power and Traction Company, Power Station, Downing Street, Smethwick, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Power Station, Smethwick; T.N., 65 Smethwick.] *Gen. Manager*, W. G. Bond; *Secretary*, B. Kingsford; *Chairman*, C. Shirreff Hilton; *Directors*, J. A. Lycett, W. L. Madgen, S. R. Blundstone, R. J. Howley.

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ELECTRIC TRAMWAYS IN THE UNITED KINGDOM.

Blackpool and Fleetwood Tramroad Company, Ltd., Bispham, near Blackpool. [T.A., Cameron, Blackpool; T.N., 121.] *General Manager and Secretary*, J. Cameron; *Elec. Eng.*, A. Cameron; *Chairman*, John Greenwood; *Directors*, R. H. Prestwich, R. B. Barningham, R. S. Boddington, G. Richardson, G. Readman.

Blackpool and Fylde Light Railway Company, 5, Clifton Street, Blackpool. (No appointment of engineer or officials yet made.) *Secretary*, R. Bibby; *Chairman*, John Greenwood; *Directors*, T. Fisher, J.P., John Platt, J.P., W. Hardman, J.P., R. H. Mabbott.

Blackpool, St. Anne's, and Lytham Tramways Company, Ltd., Squires Gate, and 30, Birley Street, Blackpool. [T.N., 327 and 22]. *Gen. Manager and Elec. Eng.*, H. W. Laing; *Traffic Manager*, G. W. Wood; *Rolling Stock Supt.*, J. Partington; *Secretary*, Chas. E. Riding; *Chairman*, G. Nicholson; *Directors*, T. M. Smith, T. Preston.

Bray and Enniskerry Railway Company, 52, Westland Row, Dublin. *Sec.*, M. F. Keogh; *Chairman*, A. Killingley; *Director*, F. M'Crea.

Brighton Beach Electric Railway, Madeira Road, Brighton. [T.A., Volk, Brighton; T.N., 14 P.O.] *Manager and Eng.*, Magnus Volk; *Traffic Superintendent*, H. Sheppard; *Per. Way Eng.*, J. Barker; *Secretary*, A. Volk; *Chairman*, Magnus Volk; *Directors*, M. H. Volk, B. W. Symonds, A. Volk.

Bristol Tramways and Carriage Company, Ltd., Clare Street House, Bristol. [T.A., Cab, Bristol; T.N., 74 & 3074 Nat.] *Manager*, Chas. Challenger; *Assist. Manager*, S. E. Smith; *Electrical Engineer*, W. H. Munton; *Permanent Way Engineer*, G. T. C. Edwards; *Secretary*, H. F. Cooper; *Chairman*, S. White, J.P.; *Directors*, W. G. Verdon Smith (*Managing*), J. H. Howell, J.P., G. Stanley White, S. E. Baker.

British Electric Traction Company, Ltd., Electrical Federation Offices, Kingsway, London, W.C. E. Garcke (*chairman*); *Directors*, C. Shirreff B. Hilton, W. L. Madgen, Sir Charles Ollivant, A. Shepherd, G. T. Symons, C. G. Tegetmeier, P. D. Tuckett; *Joint Managers*, C. H. Dade and R. J. Howley; *Acting Secretary*, T. Bower; *Accountant*, C. Walmsley.

This company is interested in the following tramways, particulars of which are given under their respective names:

Airdrie & Coatbridge.	Merthyr.
Barnsley & District.	Middleton.
Barrow-in-Furness.	Oldham, Ashton, & Hyde.
Birmingham & District Power & Traction Co.:	Peterborough.
Birmingham & Midland	Potteries.
Dudley, Stourbridge, & District.	Rothesay.
South Staffordshire.	Sheerness & District.
Wolverhampton Dist.	South Metropolitan.
Devonport & District.	Southport.
Gateshead & District.	Swansea.
General Elec. Tramways.	Taunton.
Gravesend & Northfleet.	Tynemouth & District.
Greenock & Port Glasgow.	Weston-super-Mare & District.
Jarrow & District.	Worcester.
Kidderminster & District.	Wrexham & District.
	Yorkshire (Woollen Dist.)

Burton and Ashby Light Railways, Power Station, Swadlincote, nr. Burton-on-Trent. [T.A., Toulmin, Swadlincote; T.N., 1.] *Manager and Eng.*, Jas. Toulmin; *Secretary*, A. L. Charles; *Chairman*, G. Murray Smith.

[The line is owned and worked by the Midland Railway Company.]

Camborne and Redruth Tramways, Elec. Works, Carn Brea, R.S.O., Cornwall. [T.N., 3, Camborne.] (Owned by Urban Elec. Supply Co.) *Manager and Eng.*, L. A. Hards; *Sec.*, C. H. Jones; *Chairman*, P. D. Tuckett; *Directors*, E. Charrington, H. B. Grotian, Douglas Owen.

Carlisle Tramways Company, Ltd., City of, Depot and Offices, London Road, Carlisle. [T.A., Tramways, Carlisle; T.N., 0180.] *Engineer and Manager*, R. L. McCulloch.

Chatham and District Light Railways Company, Luton Road, Chatham, and 83, Cannon Street, London, E.C. [T.A., Tramways, Chatham; T.N., 51.] *General Manager*, W. Jensen; *Assist. Manager*, A. J. Bousfield; *Traffic Manager*, ——; *Secretary*, A. Clements; *Chairman*, A. R. Monks; *Directors*, H. C. Levis, J. F. Nauheim, W. B. H. Martindale.

Cheltenham and District Light Railway Company, Cheltenham. [T.N., 341.] *Directors*, A. H. Beatty (*Chairman*), W. Shearer, H. L. Williams, A. S. Guinness, H. J. McCormick; *Sec.*, Wm. C. Bryden, C. A., 66, Queen Street, London, E.C.; *Local Eng. and Manager*, Henry J. McCormick, St. George's Road, Cheltenham.

Clontarf and Hill of Howth Tramroad Company, 39, Dame Street, Dublin. [T.A., c/o Railways, Dublin; T.N., 917.] *Secretary*, J. P. Chapman; *Chairman*, W. L. Murphy; *Directors*, E. Anderson, J. J. Dudley.

Cork Electric Tramways and Lighting Company, Ltd., Albert Street, Cork. [T.A., Tramways, Cork; T.N., 78 and 535.] *Manager and Engineer*, H. H. Nalder; *Traffic Manager*, H. G. Whiting; *Per. Way Engineer*, H. Mack; *Secretary*, A. Clements; *Chairman*, A. R. Monks; *Directors*, E. Anderson, W. M. Murphy, Capt. W. Martindale, H. C. Levis.

Dartford Urban District Council Light Railways. Car Depot, Priory Road, Dartford. [T.N., 31 Dartford.] (Leased to and worked by Balfour, Beatty, & Co., Ltd., 66, Queen Street, London, E.C.) *Acting Manager*, F. A. Kincaid Fergusson.

Devonport and District Tramways Company, Electrical Federation Offices, London, W.C. [T.A., Head Office, Devonport c/o Tramway, London; T.N., Head Office, Holborn 2686. *Manager and Eng.*, George Cardwell; *Secretary*, S. M. Wright; *Acting Sec.*, P. N. Gray; *Chairman*, C. S. B. Hilton; *Directors*, J. S. Raworth, E. R. Soames, C. G. Tegetmeier, R. J. Sutcliffe.

[The Company's undertaking has been sold to Plymouth Corporation.]

Dewsbury, Batley, and Birstall Tramways Company, Ltd., Electrical Federation Offices, Kingsway, London, W.C.

[Lines worked by Yorkshire (Woollen District) Electric Tramways, Ltd., *q.v.*]

Dewsbury and Ossett Corporation and Soothill Nether Urban District Council Tramways, (Lessees: The National Elec. Construction Co., Ltd., 3, Laurence Pountney Hill, London, E.C.) [T.A., Overhauled, London; T.N., 5329 and 5330 Bank.] *Manager*, W. MacGibbon.

Douglas—Ramsey. (The Manx Elec. Rly. Company), 1, Strathallan Crescent, Douglas. (See Manx Electric Railway Company).

Douglas Southern Electric Tramways, Ltd., Marine Drive, Douglas, Isle of Man, and 24, Brazennose Street, Manchester. [T.A., Traffic, Douglas.] *Manager and Eng.*, R. Orton; *Sec.*, J. E. Sharples; *Chairman*, T. J. Hutchinson; *Directors*, I. E. Winslow, E. A. Hopkins.

Dublin and Lucan Electric Railway Company, 15, Conyngham Road, Dublin. [T.A., Lucan Tramway, Dublin; T.N. 2282 and 4006 Dublin, and 5 Lucan.] *Manager, Elec. Eng., and Sec.*, D. McDowall Grosart, J.P.; *Chairman*, J. W. Hill, J.P.; *Directors*, E. Anderson, A. B. Coyle, J.P., G. N. Murphy.

Dublin United Tramways Company (1896), Ltd., 9, Upper Sackville Street, Dublin. [T.A., Tramways, Dublin; T.N., 58 and 59.] *Gen. Manager*, G. Marshall Harriss; *Elec. Eng.*, R. Tanham; *Con. Eng.*, H. F. Parshall; *Per. Way Eng.*, P. F. O'Sullivan; *Secretary*, W. McHugh; *Chairman*, W. M. Murphy, J.P.; *Directors*, Joseph Mooney, J.P., Rt. Hon. L. A. Waldron, J.P., William Hewat.

Dudley, Stourbridge and District Electric Traction Company, Ltd. (Section of The Birmingham and Midland Tramways Joint Committee), Power Station, Downing Street, Smethwick, Brierley Hill, Staffs., and Electrical Federation Offices, Kingsway, London, W.C. [T.N., 65 Smethwick.] *General Manager*, W. G. Bond; *Secretary*, E. H. Woodhall; *Chairman*, S. R. Blundstone; *Directors*, J. A. Lycett, R. J. Howley.

Dumbarton Burgh and County Tramways Company, Tramway Depot, Dumbarton, and 23, Rutland Street, Edinburgh. [T.A., Tramways, Dumbarton; T.N., 119.] *Gen. Manager and Elec. Eng.*, J. P. McMahon; *Secretary*, A. Dishart; *Chairman*, G. Balfour; *Directors*, K. Sanderson, K. A. Scott Moncrieff.

Dundee, Broughty Ferry & District Tramways Company, Milton, Monifieth, N.B. [T.N., 24 Monifieth.] *Gen. Manager & Engineer*, Daniel Fisher; *Secretary*, E. Cowan; *Chairman*, George Balfour; *Directors*, Edward Cowan, David Hynd.

Dunfermline and District Tramways Company, Tramway Depot, Cowdenbeath, Fife, and 8, New Row, Dunfermline. *Manager and Engineer*, J. H. Shepherd; *Secretary*, G. A. Nicolson; *Cons. Engs.*, Hawtayne & Zeden; *Directors*, Wm. Low, G. Balfour (*managing*), K. Sanderson, D. Hynd.

Falkirk & District Tramways Company, Larbert Road, Larbert, Stirlingshire. [T.A., Tramways Co., Falkirk; T.N., 154 Falkirk.] *Gen. Manager and Engineer*, D. Hays; *Chairman*, G. M. Brown; *Directors*, A. W. Tait, R. Hunter, G. Balfour, C. D. Geddes.

Felixstowe Pier Railway, Felixstowe. (The Coast Development Corporation, Ltd.) *Elec. Eng.*, E. A. Lambert.

Gateshead and District Tramways Company, Tramway Depôt, Sunderland Road, Gateshead, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramway Depôt, Gateshead; T.N., 125 & 408 Gateshead.] *General Manager*, William Morrison; *Secretary*, H. W. Davis; *Chairman*, H. S. Day; *Directors*, H. A. Stagg, C. R. Greene, Judge L. A. Atherley-Jones, K.C.

Giant's Causeway and Portrush Electric Tramway Company, Portrush. *Manager & Sec.*, W. McCurdy; *Elec. Eng.*, W. A. Traill; *Chairman*, F. J. S. Moore; *Directors*, C. M'D. Stuart, W. A. Traill.

Glossop Tramways, Electricity Works, Glossop (owned by the Urban Electric Supply Co.) [T.N., 34, Glossop.] *Manager and Res. Eng.*, C. E. Knowles; *Rolling Stock Supt.*, A. W. Bullough; *Secretary*, C. H. Jones; *Chairman*, P. D. Tuckett; *Directors*, E. Charrington, F. E. Gripper, H. B. Grotrian, D. Owen.

Gosport and Fareham Tramways, Tramways and Lighting Office, Gosport, Hants., and Moorgate Station Chambers, London, E.C. [T.A., Tramways, Gosport; T.N., 3, Post Office, Gosport.] *Eng. and Manager*, J. Fereday Glenn; *Sec.*, J. Barber Glenn; *Chairman*, A. Beattie, J.P., D.L.; *Directors*, J. Barber Glenn (*managing*), S. Hern.

Gravesend & Northfleet Electric Tramways, Ltd., Tramway Depot, Northfleet, Kent, and Electrical Federation Offices, Kingsway, London, W.C. [T.N., 958, Gravesend.] *Manager*, J. R. Groves; *Sec.*, H. C. Walter; *Chairman*, W. L. Madgen; *Directors*, P. N. Gray, W. S. Wreathall.

Great Crosby Tramways, 31, James Street, Liverpool.

[This tramway is worked by the Liverpool Overhead Railway Company.]

Great Grimsby Street Tramway Co., Southampton House, Cleethorpes, and Moorgate Station Chambers, London, E.C. [T.A., Blanco, Cleethorpes; T.N., 16.] *Manager and Eng.*, H. L. White; *Elec. Eng.*, H. O. White; *Managing Director and Secretary*, J. B. Glenn; *Chairman*, A. Beattie, J.P., D.L.; *Director*, S. Hern.

Greenock and Port Glasgow Tramways Company, Ladyburn, Greenock, and Electrical Federation Offices, Kingsway, London, W.C. [T.A. Tramways, Greenock; T.N., 562]. *Manager*, A. Robertson; *Secretary*, P. N. Gray; *Chairman*, W. L. Madgen *Directors*, G. J. Somerville, A. C. Miles, H. S. Day.

Guernsey Railway Company, Ltd., Hougue-à-la-Perre, Guernsey. *Manager and Elec. Eng.*, Arthur G. Bird; *Sec.*, J. de Mouilpied; *Chairman*, G. F. Peek; *Directors*, W. D. Murdoch, E. Valied, J. B. Collings, Q. Le Pelley.

Hampshire Light Railway (Electric) Company, Ltd., Moorgate Station Chambers, London, E.C. *Secretary*, J. B. Glenn; *Chairman*, A. Beattie, J.P.; *Directors*, J. Barber Glenn (*managing*), S. Hern.

[This company works the Portsdown and Horndean Light Railway.]

Hastings Tramways Company, Ltd., Beaufort Road, Silverhill, St. Leonards-on-Sea, and 1, Queen Victoria Street, London, E.C. [T.A., Tramways, Hastings, and Enshrine, London; T.N., 90 Hastings, and 8465, City]. *General Manager and Elec. Eng.*, W. Vincent Edwards; *Secretary*, W. R. Elston; *Chairman*, G. Kitchen; *Directors*, E. C. Morgan, J. C. Williamson, Dr. Moody.

Imperial Tramways Company, Ltd., Clare Street House, Bristol. *Secretary*, F. H. Withers; *Manager*, F. Freshwater; *Chairman*, S. White, J.P.; *Directors*, W. G. Verdon Smith (*Managing*), H. C. Godfray, J. H. Howell, Sir G. Stanley White, Bart.

Isle of Thanet Electric Tramways and Lighting Company, Ltd., St. Peter's, Kent, and Moorgate Station Chambers, London, E.C. [T.A., Tramways, St. Peters, Kent; T.N., 29 Broadstairs]. *Gen. Manager and Elec. Eng.*, J. A. Forde; *Traffic Supt.*, ——; *Secretary*, J. Barber Glenn; *Chairman*, A. R. Monks; *Directors*, Lord Arthur Butler, W. M. Murphy, H. Brown.

Jarrow and District Electric Traction Company, Ltd., Electrical Federation Offices, Kingsway, London, W.C. [T.A., Jarrow, c/o Tramway, London; T.N., 2686 Holborn.] *Traffic Manager*, G. McClelland; *Secretary*, C. W. Francis; *Acting Sec.*, H. A. Stagg; *Chairman*, G. J. Somerville; *Directors*, W. Morrison (*managing*), H. S. Day.

Kidderminster & District Electric Lighting and Traction Co., Ltd., Kidderminster and Electrical Federation Offices, Kingsway, London, W.C. [T.N., 108]. *General Manager*, W. G. Bond, *Secretary*, B. Kingsford; *Chairman*, E. Garcke; *Directors*, J. A. Lycett, H. S. Day, W. L. Madgen.

Kinver Tramway, Kinver, and Electrical Federation Offices, Kingsway, London, W.C., *q.v.*, Dudley, Stourbridge, and District Elec. Traction Co., Ltd.

Lanarkshire Tramways Company, Edinburgh Road, Motherwell, N.B., and 83, Cannon Street, London, E.C. [T.A., Tramways, Motherwell; T.N., 64.] *Gen. Manager and Eng.*, G. F. Moller; *Elec. Eng.*, E. H. Glennie; *Per. Way Eng.*, R. Foster; *Traffic Supt.*, J. L. White; *Sec.*, A. Clements; *Chairman*, A. R. Monks; *Directors*, Sir B. Cunard, H. C. Levis, W. H. Whaite, G. Franklin, J. F. Nauheim.

Lancashire United Tramways Limited, Atherton, Lancs. [T.A., Tramways, Atherton; T.N., 36, Atherton.] *Gen. Manager and Engineer*, E. H. Edwardes; *Secretary*, H. P. Conibear; *Chairman*, Hon. A. Stanley, M.P.; *Directors*, J. M. Henderson, M.P., R. Watson, J.P., A. Adam, J. S. Austen.

Liverpool and Prescot Light Railway.—This line, which with the St. Helens Tramways forms the connecting link between the City of Liverpool and South Lancashire Tramways, is owned and worked by the Lancashire United Tramways, Ltd.

Liverpool Overhead Railway Company, 31, James Street, Liverpool. [T.A., Motor, Liverpool; T.N., 5463 Central.] *Gen. Manager and Eng.*, E. J. Neachell; *Secretary*, W. H. Alexander; *Chairman*, H. C. Woodward; *Directors*, J. E. Anderson, G. D. Killey, J. U. Hodgson, M. H. Maxwell.

Llandudno and Colwyn Bay Electric Railway, Limited, Tramway Depôt, Rhôs-on-Sea, Colwyn Bay, and Basildon House, Moorgate Street, London, E.C. *Gen. Manager*, Alex. G. Balfour; *Secretary*, A. W. R. Lovering; *Directors*, G. Balfour, A. W. Tait, T. Stoker.

Llanelly and District Electric Lighting and Traction Company, Ltd., Llanelly, and 66, Queen Street, London, E.C. *Engineer and Manager*, J. E. Stewart; *Secretary*, G. D. Prince; *Chairman*, A. R. Holland; *Directors*, A. V. Anderson, M. A. Edwards, A. H. Beatty.

London United Tramways Ltd., Electric Railway House, Broadway, Westminster, London, S.W. [T.N., 6800, Victoria.] *Managing Director*, J. Devonshire; *Secretary*, A. L. Barber; *Gen. Manager and Eng.*, A. H. Pott; *Chairman*, W. M. Acworth; *Directors*, Rt. Hon. Viscount Knutsford, Sir A. H. Stanley, F. V. Schuster.

Luton Corporation Tramways (leased to and worked by Balfour, Beatty & Co., Ltd., 22a, College Hill, London, E.C.), Tramway Offices, Park Street, Luton. [T.N., 230.] *Engineer and Manager*, A. E. Wray.

Mansfield & District Light Railway Co., Sutton Road, Mansfield. [T.A., Cars, Mansfield, T.N., 107.] *Gen. Manager and Sec.*, Stanley Dudman, *Chairman*, A. R. Holland; *Directors*, W. J. Chadburn, A. H. Beatty, G. Balfour.

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ELECTRIC TRAMWAYS IN THE UNITED KINGDOM.

Manx Electric Railway Company, Ltd., 1, Strathallan Crescent, Douglas, Isle of Man, and 3, Finch Lane, London, E.C. [T.A., Electric, Douglas, Man.; T.N., 61.] *Gen. Manager & Eng.*, F. Edmondson; *Secretary*, C. A. Hunt; *Chairman*, Col. Sir A. Griffith Boscawen; *Directors*, Sir W. H. Vaudrey, B. E. Greenwell, E. Remnant.

Merthyr Electric Traction and Lighting Company, Ltd., 53, Pontmorlais Circus, Merthyr, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramway Company, Merthyr; T.N., 0180, Merthyr Tydfil.] *Managing Eng.*, L. W. Dixon; *Secretary*, S. J. Clements; *Chairman*, G. J. Somerville; *Directors*, C. G. Tegetmeier, W. L. Madgen, E. R. Soames.

Metropolitan Electric Tramways, Limited, Electric Railway House, Broadway, Westminster, London, S.W. [T.A., Metrolito, London; T.N., 6800, Victoria.] Manor House Offices, Seven Sisters Road, N. [T.A., Lentiscus, London; T.N., 77 Tottenham.] *Gen. Manager and Eng.*, A. H. Pott; *Traffic Manager*, W. E. Hammond; *Secretary*, A. L. Barber; *Chairman*, E. Garcke; *Directors*, Sir E. Spencer, W. L. Madgen, C. G. Tegetmeier, J. Devonshire (*Managing Director*).

Mexborough and Swinton Tramways Company, Electricity Works, Rawmarsh, Yorks. [T.N., 266], and 3, Laurence Pountney Hill, Cannon Street, London, E.C. *Manager and Eng.*, G. H. Browne; *Cons. Elec. Eng.*, F. E. Stanley; *Commercial Manager*, Wm. T. Mitchell; *Traffic Supt.*, M. McLeod; *Secretary*, L. D. H. Jacobs; *Chairman*, L. B. Schlesinger; *Director (Managing)*, W. B. Cownie, C.A.

Middlesbro, Stockton, and Thornaby Electric Tramway, Bridge Road, Stockton-on-Tees, and Clare Street House, Bristol. [T.A., Tramways, Stockton; T.N., 129.] *Manager*, F. Freshwater; *Secretary*, F. H. Withers; *Chairman*, Samuel White, J.P.; *Directors*, H. C. Godfray, James H. Howell, J.P., W. G. Verdon Smith (*Managing Director*)

Middleton Electric Traction Company, Ltd., Hiltonfold Lane, Middleton, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramway Depot, Middleton; T.N., 37 Middleton.] *Gen. Manager*, W. F. Endean; *Secretary*, G. R. Oliphant; *Acting Secretary*, J. S. Bowker; *Chairman*, Lord Vaux of Harrowden; *Directors*, J. V. Kitchener, W. S. Wreathall.

Morecambe Tramways Company, Heysham Road, Morecambe, and 62, Market Street, Lancaster. [T.N. 1, Morecambe, and 71, Lancaster.] *Secretary and Manager*, G. H. Petty; *Chairman*, W. H. Pickles; *Directors*, J. Stott, S. Wright, O. Carr.

Musselburgh and District Electric Light and Traction Co., Ltd., High St., Musselburgh, N.B. [T.A., Tramways, Musselburgh; T.N., 115.] (Registered Office, 3, Laurence Pountney Hill, London, E.C. [T.N., 5329 and 5330, Bank.]) *Manager*, E. J. Walsh; *Resident Engineer*, E. J. Walsh; *Traffic Inspector*, W. Mittell; *Secretary*, L. D. H. Jacobs; *Chairman*, L. B. Schlesinger; *Directors*, B. Burnham, J. Anderson, W. B. Cownie, R. Watson.

New General Traction Company, Ltd., 8, Crosby Square, London, E.C. *Managing Director*, E. A. Hopkins; *Secretary*, J. G. Mills; *Chief Engineer*, I. E. Winslow; *Chairman*, Baron E. B. d'Erlanger. [This company controls the Norwich and the Douglas Southern Electric Tramways Companies.]

New St. Helens and District Tramways Company, Ltd., Atherton, Lancs. [T.A., Tramways, Atherton; T.N., 36 Atherton.] *Engineer and Manager*, C. D. Stanley; *Secretary*, H. P. Conibear; *Chairman*, Hon. Arthur Stanley, M.P.; *Directors*, J. Hunter, J.P., H. Martin, J.P., J. M. Henderson, M.P., J. S. Austen, and E. H. Edwardes (*Managing*).

North Shields Tramway Company owned and worked by Tynemouth and District Elec. Trac. Co. *q.v.*

Norwich Electric Tramway Company, 5, Orford Hill, Norwich, and 8, Crosby Square, London, E.C. [T.A., Tramways, Norwich; T.N., 475.] *Manager and Engineer*, F. W. Ketley; *Consulting Eng.*, I. E. Winslow; *Sec.*, J. G. Mills; *Directors*, E. A. Hopkins, Hon. A. G. Brand, F. FitzGerald, G. M. Chamberlin, and C. Pakeman.

Nottinghamshire and Derbyshire Tramways Company, Tramway Depot, Langley Mill, Derbyshire, and 66, Queen Street, London, E.C. [T.A., Tramways, Langley Mill; T.N., 53, Langley Mill.] *Manager*, C. R. Walker; *Secretary*, Wm. C. Bryden; *Directors*, A. R. Holland, A. H. Beatty, A. V. Anderson, and M. A. Edwards.

Oldham, Ashton and Hyde Electric Tramway, Ltd., Tramway Depot, Denton, Lancs., and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Denton; T.N., 265 Ashton.] *Supt.*, A. Anderson; *Secretary*, F. J. Cursons; *Acting Secretary*, J. S. Bowker; *Chairman*, E. Garcke; *Directors*, Judge L. A. Atherley Jones, K.C., W. S. Wreathall, J. V. Kitchener (*Managing Director.*)

Paisley District Tramways Company, Tramway Depôt, Paisley, and 83, Cannon Street, London, E.C. [T.N., 218 Paisley.] *Gen. Manager and Elec. Eng.*, Fred Coutts; *Traffic Supt.*, E. Jeffs; *Secretary*, A. Clements; *Con. Eng.*, H. F. Parshall; *Chairman*, O. H. Smith; *Directors*, Lord Arthur Butler, D. Johnston Smith, John Young.

Peterborough Electric Traction Company, Ltd., Lincoln Road, Peterborough, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Peterborough; T.N., 224.] *Gen. Manager*, T. G. Clabburn; *Secretary*, S. M. Wright; *Acting Sec.*, P. N. Gray; *Chairman*, Lord Vaux of Harrowden; *Directors*, E. A. Paris, R. J. Howley.

Plymouth, Stonehouse and Devonport Tramways Co., 16, Edgcumbe Street, Stonehouse, Devon, and Moorgate Station Chambers, London, E.C. [T.N. 53.] *Manager*, G. H. Moreton; *Elec. Eng.*, J. Graham Pearce; *Sec.*, J. Barber Glenn; *Chairman*, Andrew Beattie, J.P., D.L.; *Directors*, S. Hern, J. B. Glenn (*Managing*).

Portsdown and Horndean Light Railway, Cosham, Hants.; Tramways and Lighting Office, Gosport, Hants., and Moorgate Station Chambers, London, E.C. [T.A., Tramways, Gosport; T.N., 3, Post Office, Gosport.] *Engineer and Manager*, J. Fereday Glenn; *Secretary*, J. Barber Glenn; *Chairman*, A. Beattie, J.P., D.L.; *Directors*, J. Barber Glenn (*Managing*), S. Hern.

Potteries Electric Traction Company, Tramway Depôt, Stoke-on-Trent, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Stoke-on-Trent; T.N., 141.] *Gen. Manager and Eng.*, W. Thom; *Power and Rolling Stock Supt.*, F. J. Chapple; *Traffic Manager*, F. Hatch; *Secretary*, B. Kingsford; *Chairman*, R. J. Howley; *Directors*, F. W. Chanter, S. Mear, J. V. Kitchener.

Rhondda Tramways Company, Ltd., Tramway Depot, Porth, Rhondda, and Laurence Pountney Hill, Cannon Street, London, E.C. [T.A., Tramways, Porth; T.N., 118.] *Manager and Engineer*, H. Holliday; *Secretary*, L. D. H. Jacobs; *Chairman*, L. B. Schlesinger; *Directors*, J. C. Saunders, W. B. Cownie, J. T. Jervis, H. T. Barnett.

Rothesay Tramways Company, Ltd., Point House, Rothesay, and Electrical Federation Offices, Kingsway, London, W.C. *Manager*, A. Robertson; *Sec.*, P. N. Gray; *Chairman*, A. C. Miles; *Directors*, W. L. Madgen, H. S. Day.

Ryde Pier Company, Ryde, Isle of Wight. *Manager*, W. D. Stanney; *Elec. Eng.*, C. Harrison; *Chairman*, G. E. Mears.

Scarborough Tramways Company, Scalby Road, Scarborough. [T.A., Electric Tramways, Scarborough; T.N., 294.] *Gen. Manager and Elec. Eng.*, J. V. Moinet; *Chairman*, F. E. Gripper; *Directors*, V. Fowler, M. T. Whittaker, J. C. Wigham.

Sheerness and District Electric Power and Traction Company, Ltd., Electricity Works, Sheerness East, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Sheerness; T.N.,45.] *Manager & Eng.*, A. Charlton; *Sec.*, H. A. Stagg; *Chairman*, G. J. Somerville; *Directors*, R. J. Howley, E. R. Soames.

Snaefell Mountain Railway (See Manx Electric Railway Company).

South Metropolitan Electric Tramways and Lighting Company, Ltd., 114, Church Street, Croydon, 80, High Street, Sutton, and Electric Railway House, Broadway, Westminster, London, S.W. [T.N., 304 Croydon, 14 Sutton and 6800, Victoria.] *Gen. Manager and Engineer*, A. V. Mason; *Secretary*, W. M. Wright; *Chairman*, C. G. Tegetmeier; *Directors*, J. Devonshire (*managing*), E. Garcke, A. L. Barber.

Southport Pier Co., Ltd., Southport. [T.A., Pier, Southport; T.N., 174.] *Manager*, A. T. Faiers; *Chairman*, A. Skinner; *Directors*, J. R. Haworth, S. J. Fane, G. Duckworth, J. Duckworth.

Southport Tramways Company, Ltd., The Depôt, Churchtown, Southport, and Electrical Federation Offices, Kingsway, London, W.C. *Manager*, J. Lloyd; *Secretary*, H. A. Stagg; *Chairman*, C. S. Hilton; *Directors*, J. S. Raworth, Lord Vaux of Harrowden, J. V. Kitchener, G. R. Hulme.

South Staffordshire Tramways (Lessee) Company, Ltd., Electrical Federation Offices, Kingsway, London, W.C. [T.N., 65 Smethwick.] *General Manager*, W. G. Bond; *Secretary*, E. H. Woodhall; *Chairman*, W. S. Schuster; *Directors*, J. A. Lycett, S. R. Blundstone, R. J. Howley, B. Kingsford.

Sunderland District Electric Tramways. Ltd., Fence Houses, co. Durham. [T.A., Trams, Philadelphia, Shiney Row; T.N., 21, Houghton-le-Spring.] *Resident Manager and Engineer*, G. Stratton; *Traffic Manager*, E. A. Pearman; *Secretary*, H. J. Almond; *Directors*, H. R. Hogg, Hon. R. Parker, R. Tayler, A. Counter, C. Eves.

Sutton and Howth Electric Tramway Company (owned by the Great Northern Railway, Ireland), Sutton, county Dublin, and Amiens Street Station, Dublin. [T.A., Railroad, Dublin; T.N., 171, Dublin, and 16 Sutton.] *Gen. Manager*, John Bagwell; *Elec. Eng.*, A. W. Whieldon; *Chief Eng.* F. A. Campion; *Locomotive Eng.*, G. T. Glover; *Sec.*, T. Morrison; *Chairman*, F. Vernon; *Directors*, W. P. Cairnes (*Deputy Chairman*), W. B. Carson, H. S. Guinness, J. T. Reade, Capt. W. L. A. Goulding, Lt.-Col. J. C. W. Madden, R. A. Gradwell, J. Milne Barbour, T. F. Cooke, W. H. B. Moorhead, Lt.-Col. H. Plews, G. S. Clark.

Swansea Improvements and Tramways Company, 2, Rutland St., Swansea, and Electrical Federation Offices. Kingsway, London, W.C. [T.A., Tramway, Swansea; T.N., 268 Swansea.] *Gen. Manager*, D. James; *Elec. Eng.*, A. Johnston; *Secretary*, S. J. Clements; *Chairman*, C. G. Tegetmeier; *Directors*, G. J. Somerville, S. E. Garcke, E. R. Soames.

Taunton Electric Traction Company, Ltd., East Reach, Taunton, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Taunton, c/o "Tramways," London.] *Manager*, B. H. Griffith; *Acting Manager*, L. Marshall; *Secretary*, S. M. Wright; *Acting Sec.*, P. N. Gray; *Chairman*, G. J. Somerville; *Directors*, E. Garcke.

Torquay Tramways Co., Ltd., St. Marychurch Road, Torquay. [T.A., Carsheds, Torquay; T.N., 167 Torquay.] *Registered Office*, 3, Laurence Pountney Hill, Cannon Street, E.C. *Manager and Eng.*, H. J. Nisbett; *Secretary*, L. D. H. Jacobs; *Managing Director*, W. B. Cownie.

Trafford Park Company (Tramways), Trafford Park, Manchester. [T.A., Developing, Manchester; T.N., 61, Trafford Park.] *Secretary*, C. A. Grundy; *Chairman*, Marshall Stevens; *Directors*, Sir J. Lyons, H. McNiel, J. H. Balfour Browne, K.C.

[Lines worked by the Manchester and Salford Corporations.]

Tynemouth and District Electric Traction Company, Limited, John Street, Cullercoats, Northumberland, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tram Co., Cullercoats; T.N., 17 Whitley.] *Gen. Manager*, H. J. Smith *Sec.*, C. W. Francis; *Acting Sec.*, H. A. Stagg; *Chairman*, H. S. Day; *Directors*, J. H. Robinson, J. B. Williamson, R. J. Howley, Geo. J. Somerville.

Tyneside Tramways and Tramroad Company, Ltd., Neptune Bank, Wallsend. [T.A., Tramways, Wallsend; T.N., 84.] *Secretary & Res. Manager*, J. C. Little; *Elec. Eng.*, F. H. Briggs; *Cons. Eng.*, W. McLellan; *Chairman*, J. T. Merz; *Directors*, Lord Armstrong, J. H. Armstrong, G. E. Henderson, S. Hunter.

Wakefield and District Light Railway Company, Belle Isle, Wakefield.
[This company has been amalgamated with the Yorkshire (West Riding) Electric Tramways Co., Ltd.]

Walton-on-the-Naze Pier Tramway (Coast Development Corporation, Ltd.), The Pier, Walton-on-the-Naze. [T.A., Electricity Works, Walton-on-Naze.] *Eng.*, E. A. Lambert, A.M.I.E.E.

Wemyss and District Tramways Company, Ltd., Car Depot. Aberhill, Methill, N.B. [T.A., Tramways, Methill; T.N., 88 Leven.] *Gen. Manager*, W. T. Dawson; *Sec.*, J. O. Shepherd; *Chairman*, G. Balfour; *Directors*, W. Shepherd, G. Balfour, J. H. Guild.

Weston-super-Mare and District Electric Supply Co., Ltd., Locking Road, Weston-super-Mare, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Weston-s.-Mare; T.N., 79 & 181.] *Manager and Elec. Eng.*, G. Charlton; *Sec.*, H. A. Stagg; *Chairman*, G. J. Somerville; *Directors*, C. G. Tegetmeier, E. R. Soames.

Wolverhampton District Electric Tramways, Limited, Tramway Depot, Bilston, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Bilston; T.N., 56, Bilston.] *General Manager*, W. G. Bond; *Sec.*, E. H. Woodhall; *Chairman*, S. R. Blundstone; *Directors*, J. A. Lycett, R. J. Howley, B. Kingsford.

Worcester Electric Traction Company Ltd., St. John's, Worcester, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Worcester; T.N., 81.] *Engineering Manager*, R. Simpson; *Secretary*, C. W. Francis; *Acting Sec.*, H. A. Stagg; *Chairman*, H. S. Day; *Directors*, J. A. Lycett, B. Kingsford, W. S. Wreathall.

Wrexham and District Transport Co., Ltd., 6, Lord Street, Wrexham, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Wrexham; T.N., 182, Wrexham.] *Manager*, A. A. Hawkins; *Sec.*, J. R. Oliphant; *Acting Sec.*, J. S. Bowker; *Chairman*, J. V. Kitchener; *Directors*, G. J. Somerville, W. S. Wreathall.

Yorkshire (West Riding) Electric Tramways Co., Ltd., Belle Isle, Wakefield. [T.A., England, Belle Isle, Wakefield; T.N., 213.] *Gen. Manager and Sec.*, H. England: *Elec. Engs.*, C. J. Jewell and E. A. Wood; *Traffic Supt.*, W. J. McDonald; *Chairman*, Sir Herbert S. Leon, Bart.; *Directors*, B. Newgass, G. E. Leon, E. Remnant, W. Murray.

Yorkshire (Woollen District) Electric Tramways, Limited, Frost Hill, Liversedge, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Heckmondwike; T.N., 8 Heckmondwike.] *Secretary*, P. N. Gray; *Chairman*, E. Garcke; *Directors*, Sir Thos. Pilkington, E. A. Paris (*managing*).

TRAMWAY ASSOCIATIONS.

MUNICIPAL TRAMWAYS ASSOCIATION

President:
HENRY MOZLEY
(General Manager, Burnley Corporation Tramways).

Vice-President:
Alderman JOHN MILES, J.P.
(Chairman, Bolton Corporation Tramways).

Hon. Secretary and Treasurer:
C. J. SPENCER
(General Manager, Bradford Corporation Tramways),

Hon. Secretary Pro. Tem.:
A. R. FEARNLEY
(General Manager, Sheffield Corporation Tramways).

Offices: 7, Hall Ings, Bradford.

TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION.

President:
The Rt. Hon. VISCOUNT CHILSTON.

Chairman:
The Hon. ARTHUR STANLEY, M.P.

Vice-Chairman:
HARRY ENGLAND.

Hon. Solicitor: W. MORRIS, Junr.
Hon. Auditor: A. W. CHAMBERS, A.S.A.A.

Secretary:
A. DE TURCKHEIM.

Offices: Sanctuary Chambers, Tothill Street, Westminster, London, S.W.
Telephone No. 2110 Victoria.

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LIST OF ELECTRIC TRAMWAYS & RAILWAYS.

PARTICULARS OF TRACK AND EQUIPMENT.

TRAMWAYS, pp. xxvii-xxx. RAILWAYS, p. xxx.

Location of Line and Name of Operating Company.	Date of Opening of First Section.	Length of Route.	Total length of Track.	Gauge.	Weight and Type of Rail.	Maximum Gradient.	Sharpest Curve.	No of Motor Cars.	No of Dynamos	No. of Engines	Type of Engines	Total Capacity Traction, kw.	Principal Contractors for Electrical Equipment.
TRAMWAYS.				ft. in.	lbs.	1 in	ft. rad.						
Aberdare Urban District Trys. ..	Oct., 1913	2·9	3·3	3 6	96 G	13	45	14	2	2	V. Cp. C.	400	Lanc. Dynamo Co.
Aberdeen Corporation	Dec., 1899	14·4	27·75	4 8½	96 G	13	42·5	83	*14	14	V. Cp. C.	4,610	British T-H. Macartney & Co.
Aberdeen Suburban Trys. Co. ..	June, 1905	5	5	4 8½	95 G	28	90	9	..	..	..	..	J. G. White & Co. Brush Co.
Accrington Corporation	Aug., 1907	7·53	10·53	4 0	95 G	14	..	32	*8	8	..	1,888	Brush Co.
Airdrie & Coatbridge Tramway Co.	Feb., 1904	3·63	4·94	4 8½	94 G	14	210	15	..	..	..	..	Brush Co.
Ashton-under-Lyne Corporation ..	Aug., 1902	7	8·15	4 7¾	96 G	10	40	25	5	5	..	400	Dick, Kerr, & Co. Siemens Bros.
Ayr Corporation	Sept., 1901	6	7·612	4 8½	90 G	21	45	24	*8	8	..	400	British T-H.
Bacup Corporation	1910	1·50	2	4 8½	103 G	9	40	..	..	..	..	..	
Barking Town Urban District ..	Dec., 1903	2·6	3·125	4 8½	100 G	25	44	9	4	3	V. Cp. C.	200	Blackwell & Co.
Barnsley & Dist. Elec. Traction Co.	Nov., 1902	3·06	4·25	4 8½	97 G	10	60	13	*	..	..	..	J. G. White & Co. Brush Co.
Barrow-in-Furness	Feb., 1904	6·9	10·32	4 0	90 G	13	50	24	*8	..	..	..	Brush Co. Dick, Kerr, & Co.
Bath Electric Tramways, Ltd. ..	Jan., 1904	14·7	19·3	4 8½	95 G	10·7	38	40	4	4	H.T. Cp.	675	Westinghouse
Batley Corporation	Aug., 1903	6·536	10·47	4 8½	104 G	9	40	15	6	4	H. Cp.	240	B. I. W. Co. British Elc. Cr. Co
Belfast City	Dec., 1905	49·65	98·54	4 8½	105 G	15	35	291	3	3	Tri. Exp.	3,000	J. G. White & Co. Westinghouse
Bessbrook—Newry (1) .. .. Bessbrook and Newry Try. Co.	Oct., 1885	3	3	3 0	41 V	80	55	2 M 2 T	2	1	Hyd. Turb.	..	Mather & Platt
Bexley Urban District	Oct., 1903	5·25	6·5	4 8½	90 G	14	40	21	3	3	V. Cp.	600	Dick, Kerr, & Co.
Birkenhead Corporation	Feb., 1901	13·8	24·09	4 8½	100 G	13½	40	65	6	6	V. Cp.	..	Blackwell & Co. British T-H.
Birmingham Corporation	Jan., 1904	65·56	123	3 6	105 G	13	40	586	..	..	..	1,475	Dick, Kerr, & Co.
Birmingham and Midland Trys. Co.	Nov, 1904	10·32	16·45	3 6	85 & 94 G	15	31	62	6	6	Cp.	..	Brush Co.
Blackburn Corporation	March, 1899	14·67	24·75	4 0	92 G	15	30	61	*4	4	V. Cp. C.	..	British T-H. Blackwell & Co.
Blackpool Corporation	Oct., 1885	14·75	21·38	4 8½	96 G	20	36	84	5	..	Turb.	3,250	Elwell-Parker British T-H.
Blackpool & Fleetwood Tramrd. Co.	July, 1898	7·9	15	4 8½	70 V 98 G	26	80	41	5	5	V. Cp.	600	Mather & Platt D.K.&Co.-B.T-H.
Blackpool and Fylde Light Ry. Co.	Under cons.	14	14·5	4 8½	..	..	..	..	..	..	..	..	
Blackpool—St. Anne's & Lytham ..	May, 1903	7·47	14·03	4 8½	92 G	22	35	40	..	..	..	..	British T-H.
Bolton Corporation	Nov., 1899	26	47·8	4 8½	90 G	14	35	112	*12	12	V. Cp. C.	3,800	Dick, Kerr, & Co. Blackwell & Co.
Bootle Corporation	May, 1900	4·125	7·75	4 8½	95 G	20	40	55	*8	8	..	4,000	Blackwell & Co.
Bournemouth Corporation	July, 1902	21·66	32·75	3 6	100 G 66 slot	10	40	91	5	4	V. Cp.	1,200	J. G. White & Co.
Bradford Corporation	July, 1898	59	108·75	4 0	102 G	9·8	40	‡272	11	11	V. Cp. C.	..	Westinghouse Blackwell & Co.
Bray and Enniskerry Railway Co.	Under cons.	3·25	5	3 6	..	..	..	..	..	..	..	..	
Brighton Corporation	Nov., 1901	9·48	17·19	3 6	105 B.S. No. 4	9	40	53	5	5	Turb.	1,000	Macartney & Co. Westinghouse Blackwell & Co.
Brighton Beach (1)	Aug., 1883	1·75	2	2 8½	35 V	100	80	9	2	..	..	..	Siemens Bros.
Bristol—Bristol Trys. Co.	Oct., 1895	31	57·5	4 8½	92½ G	10	30	232	6	4	V. Cp. C.	..	British T-H. and Blackwell & Co.
Burnley Corporation	Dec., 1901	12·50	22·16	4 0	102 & 107 G	9·8	35	67	*8	6	H. Cp. C.	1,500	British T-H.
Burton and Ashby Light Railway..	July, 1906	10·2	12·3	3 6	90 G	11	51	20	2	2	Diesel	330	Dick, Kerr & Co. Brush Co.
Burton-on-Trent Corporation ..	Aug., 1903	6·67	9·75	3 6	90 & 100 G	11·7	40	20	3	3	V. Cp.	400	Dick, Kerr, & Co. Blackwell & Co.
Bury Corporation	June, 1903	22·5	37·75	4 8½	102¾ G	12	40	54	6	6	..	1,500	Westinghouse
Camborne and Redruth	Nov., 1902	3·75	4	3 6	83 G	15	40	8	7	7	Cp.	1,525	Dick, Kerr, & Co British T-H.
Cardiff Corporation	May, 1902	17·25	31·82	4 8½	100 G	23	35	130	9	9	V. Cp. C&T	2,200	British T-H. Dick, Kerr, & Co.
Carlisle, City of, Elec. Try. Co. ..	June, 1900	7·25	8·5	3 6	83 G	14	23	12	..	..	..	..	D.K.& Co.-B.T-H.
Cavehill & Whitewell Try. Co...	Feb., 1906	3·29	4·31	4 9	105 G	31	75	10	..	..	..	..	J. G. White & Co.
Chatham & District Light Rly. Co.	June, 1902	14·98	26	3 6	92½ & 105 G	9	35	50	5	4	H. Cp.	675	British T-H. Co. Brush Co.
Cheltenham and District ..	Aug., 1901	10·22	12·25	3 6	80 & 90 G	8·9	37	20	2	2	V. Cp.	..	Westinghouse
Chester Corporation..	April, 1903	3·59	6·4	3 6	94 & 100 G	23	40	18	*7	6 V. Cp. C. 1 V. Tri. Ex C		240	Blackwell & Co. British T-H.
Chesterfield Corporation	Dec., 1904	3·6	5·1	4 8½	96 & 101 G	20	40	17	4	4	V. Cp. C.	800	Milnes & Co. Westinghouse Brush
Clontarf and Hill of Howth ..	July, 1900	5·5	6·5	5 3	90 & 60 G	13	34	12	..	..	..	..	W.M. Murphy & Co.
Colchester Corporation	July, 1904	6	7·94	3 6	95 G	12	43	18	8	8	V. Cp.	1,140	Dick, Kerr & Co. J. G. White & Co.
Colne Corporation Tramways ..	Nov., 1903	5·2	6·7	4 0	102 G	13	60	13	*	..	..	..	Blackwell & B.T-H. Glover & Co.
Cork Elec. Try. & Lighting Co. ..	Dec., 1898	10	15.	2 11½	83 G	14	26	35	*9	9	H. Cp. C.	570	British T-H. Blackwell & Co.
Coventry Corporation Tramways..	Dec., 1895	12·88	15·81	3 6	65 G 81 G	16	35	51	5	3	H. & V. Cp.	1,500	Westinghouse Blackwell & Co.
Croydon Corporation	Sept., 1901	11·87	19·12	4 8½	96·5 G	16	40	75	*13	13	..	2,000	British T-H. Co.
Darlington Corporation	June, 1904	4·875	8·88	3 6	90 G	14	52·8	18	1	..	..	250	Westinghouse

* Current from combined lighting and traction station. (1) Third rail system. † Includes 1·25 miles railless trolley line. ‡ Includes 20 railess cars.
M—Motor Cars. T—Trail Cars.

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ELECTRIC TRAMWAYS & RAILWAYS.—Particulars of Track and Equipment.

Location of Line and Name of Operating Company.	Date of Opening of First Section.	Length of Route.	Total Length of Track.	Gauge.	Weight and Type of Rail.	Maximum Gradient.	Sharpest Curve.	No. of Motor Cars	No. of Dynamos	No. of Engines	Type of Engines.	Total Capacity Traction, kw.	Principal Contractors for Electrical Equipment.
TRAMWAYS—*continued.*				ft. in.	lbs.	1 in	ft. rad.						
Dartford U. D. C.	Feb., 1906	6·5	8·5	4 8½	100 G	12	35	12	4	..	..	..	British I. W. / British T-H.
Darwen Corporation	Oct., 1900	4·36	7·16	4 0	95 G	9	35	19	*4	4	H. Cp.	..	
Derby and Ashbourne	..	14·5	..	4 8½									J. G. White & Co. / Brush & B.T-H.
Derby Corporation	July, 1904	13	22·25	4 0	95 G	14	46	50	3	3	Turb.	..	
Devonport Corporation	June, 1901	..	7	3 6	97 G	10	50	12	..	..	..	..	Blackwell & Co.
Doncaster Corporation	June, 1902	8·25	12·52	4 8½	94 G	16	45	32	8	8	..	1,000	Blackwell & Co.
Dover Corporation	Sept., 1897	4·75	7	3 6	87 & 90 G	10	44	24	*2	2	H.CC.	..	D K. & B. T-H
Douglas—Port Soderick .. / Douglas Southern Elec. Trys. Co.	Aug., 1896	3·25	3·75	4 8½	65 V	12	45	8 M / 8 T	2	2	H. Cp.	200	Westinghouse / British T-H.
Dublin & Lucan Elec. Railway Co.	March, 1900	6·5	7	3 6	50 V	20	27	9 M / 5 T	2	2	H.Cp.C.	240	Dick, Kerr, & Co.
Dublin United Tramways Co.	May, 1896	49·8	100·75	5 3	105 G	12·3	22	365	8	8	Cp.&Tur	5,500	Dick, Kerr, & Co. / Blackwell & Co. / British T-H.
Dudley and Stourbridge Trys. / British Electric Traction Co.	July, 1899	22·88	30·97	3 6	90 G	11	50	59	4	4	H. Cp.	..	British T-H. / Blackwell & Co.
Dumbarton	Feb., 1907	13	17	4 7½	90 & 96	14	60	30	3	3	..	..	Dick, Kerr, & Co. / White & B.T-H.
Dundalk	Under cons.	6	6·25	3 6	97 G	10	50	12					
Dundee, Broughty Ferry, and District	Dec., 1905	4·125	7·25	4 8½	90 G	16·5	30½	14	3	3	V. Cp.C.	..	J. G. White & Co. / British T-H. Co.
Dundee Corporation	July, 1900	16·3	30·12	4 8½	90 & 100 G	10	35	76	5	5	..	..	Blackwell & Co.
Dunfermline (Fife Try. & Power Co.)	Nov., 1909	14·6	17·4	..	90 G	10	25	28	..	..	..	..	British T-H.
East Ham Corporation	June, 1901	7·58	14·20	4 8½	90 & 105 G	25	40	45	*5	5	H. Cp.	750	Dick, Kerr, & Co.
Eccles Corporation	May, 1902	5	7·75	4 8½	100 G	..	..	..	..	..	..	..	
Edinburgh and District	June, 1910	1·25	1·5	4 8½	100 G	21	54	4	..	..	..	..	Dick, Kerr, & Co.
Erith Urban District Council	Aug., 1905	4·7	8·4	4 8½	100 G	17	40	17	3	5	..	..	Brush Co. / WestinghouseCo.
Exeter Corporation	April, 1905	4·875	7	3 6	90 G	11·5	35	24	*4	4	H. Cp.	..	Dick, Kerr, & Co.
Falkirk and District	Oct. 1905	7·81	10·5	4 0	90 G.	11·3	48	18	*	..	..	..	Bruce-Peebles / British T-H.
Farnworth Urban District	Jan., 1902	4·33	7·16	4 8½	98 G	29	36	..	..	..	..	..	
Felixstowe Pier	Aug., 1905	0·5	0·5	3 6	36	..	..	3	..	..	..	..	
Gateshead and District	May, 1901	12·38	20·02	4 8½	90 G	8	35	55	*	..	..	..	Dick, Kerr, & Co. / Blackwell & Co.
Giant's Causeway Elec. Try. Co.	Sept., 1883	8	9	3 0	42 V / 75 G	24	30	5 M / 21 T	2	2	Hyd. Turb.	..	Siemens Bros. / British T-H.
Glasgow Corporation	Oct., 1898	99·26	198·25	4 7½	110 G	11·93	30¾	857	8	8	V. Cp. & T	21,700	British T-H. / Westinghouse
Glossop Urban District	Aug., 1903	4·56	5·6	4 8½	90 G	13	40	8	4	4	V. Cp.	200	British T-H.
Gloucester Corporation Light Rly.	May, 1904	9	15	3 6	90 G	25	40	30	*2	2	Cp.	750	Brush Co. / Dick, Kerr, & Co.
Gosport & Fareham Trys. Co.	Jan., 1906	7·5	11·5	4 7½	96 G	16	37½	22	3	3	V. Cp.C.	750	Dick, Kerr, & Co. / Brush Co.
Gravesend and Northfleet	Aug., 1902	6·5	9	4 8½	87 G	11	45	18	*				
Great Crosby	June, 1900	2·5	2·5	4 8½	92½ G	..	40	14	*7	7	H. & V. Cp.	160	Dick, Kerr, & Co. / Blackwell & Co.
Great Grimsby	Dec., 1901	6	11	4 8½	90 G	15	26	32 M / 6 T	3	3	..	400	Dick, Kerr, & Co.
Greenock and Port Glasgow	Oct., 1901	7·425	14·05	4 7½	90 G	11	60	42	*	..	..	..	
Guernsey Railway Co.	Nov., 1892	3	3	4 8½	74 V / 84 G	60	60	9 M / 8 T	2	1	H. & V. Cp.	160	Siemens Bros. / British T-H.
Halifax Corporation	June, 1898	37·53	55·5	3 6	95½ G	9·5	38·6	101	*7	7	H. & V. Cp. & T.	3,000	Electric Cons. Co. / British T-H.
Hampshire Light Railway (Elec.) Co.	March, 1903	6	9	4 8½	..	..	..	10	*	..	..	..	
Haslingden Corporation	July, 1908	3	3	4 0	100 G	10	30	..	..	..	..	45	Dick, Kerr, & Co.
Hastings and District	July, 1905	19·33	33·25	3 6	90 G	8	30	65	6	6	V. Cp.	2,100	Dick, Kerr, & Co.
Herne Bay Pier (1)	March, 1899	·75	·75	3 0	60	..	..	3	1	1	Gas	50	British T-H.
Heywood Corporation	Dec., 1905	4·25	4·25	4 8½	90 G	17	..	..	1	1	..	300	Blackwell & Co. / B.I. & H.C. Co.
Houghton-le-Spring (See Sunderland Dist. Elec. Trys.)													
Huddersfield Corporation	Feb., 1901	34·50	56	4 7½	98 G	11	35	106	4	4	V. Cp.C.	2,200	British T-H.
Hull Corporation	July, 1899	13·46	29·5	4 8½	94 G	20	30	180	7	7	V. Cp.C.	2,560	British T-H. / Westinghouse
Ilford Urban District	Mar., 1903	7·42	12·62	4 8½	95 G	13	33·3	28	*7	7	..	1,600	British T-H. / Dick, Kerr, & Co.
Ilkeston Tramways	May, 1903	3·8	4·3	3 6	90 G	12	28	13	..	..	..	..	Dick, Kerr, & Co.
Ipswich Corporation	Nov., 1903	10·8	14·87	3 6	90 G	11·5	40	36	*10	10	Enclos'd	1,175	Westinghouse
Isle of Man—													
Manx Elc. Rly. Co. — Douglas to Ramsey	July, 1893	18	35·75	3 0	62½ V	24	90	34 M / 29 T	8	9	H. Cp.	1,300	Mather & Platt
Manx Elc. Rly. Co. — Snaefell Mountain	Aug., 1895	4·5	9·5	3 6	56 V	12	90	6	5	4	H. Cp.	390	
Isle of Thanet Trys. & Ltg. Co.	April, 1901	11	20·67	3 6	90 & 100 G	11	38	59	*6	6	3 V. Cp. / 3 H. Cp.	800	British T-H. / Blackwell & Co.
Jarrow and District	Nov., 1906	2·54	3·42	4 8½	95 G	12·5	50	10	..	..	..	..	Brush Co. / B.I. & H.C. Co.
Kearsley Urban District	Jan., 1902	1·75	1·75	4 8½	95 G	20	..	..	..	..	..	..	Westinghouse
Keighley Corporation	Oct., 1904	3·5	6·11	4 0	95 G	25	60	12	*4	4	V.	200	Blackwell & Co. / Brush & B.T-H.
Kidderminster—Stourport / British Electric Traction Co.	May, 1898	4·6	4·87	3 6	75 G	14	45	13	*5	5	Stm Turb.	..	Brush Elc. Eg. Co
Kilmarnock Corporation	Dec., 1904	4·18	5·5	4 8½	90 G	24	45	14	*3	3	..	250	Blackwell & Co.
King's Norton & Northfield U. D.	May, 1904	5·25	8·25	3 6	105 G	15&21	100&145	..	..	..	..	..	Blackwell & Co.
Kinver	April, 1901	4·25	6	3 6	63 & 90 G	..	..	6					
Kirkcaldy Corporation	Feb., 1903	6·11	8·56	3 6	100 G	11	40	26	*10	6	Cp. H.T.	2,290	British T-H. Co.
Lanarkshire Tramway Co.	July, 1903	28·431	43·120	4 7½	96 & 101 G	9·4	37	76	4	4	3 H. Cp. / 1 V. Cp.	825	British T-H. Co.
Lancashire United Tramways Co.	Oct., 1902	39	42	4 8½	90 G	15	50	82	*8	8	V. Cp. C&T	7,000	B. I. W. Co.
Lancaster Corporation	Jan., 1903	4	4·81	4 8½	90 G	8	30	12	4	4	V. Cp.	200	Greenwood & Batley, Ltd.
Leamington & Warwick Elec. T. Co.	July, 1905	3·04	6·1	3 6	65 G	12	47	12	3	3	Cp.	..	Brush Co.
Leeds City	Aug., 1897	69·02	126·75	4 8½	105 & 111 G	8·4	32	345	5 / 3	5 / 3	H. Cp. C. / Stm. Tur	6,150	Elec. Con. Co. / Greenwood & Batley, British T-H. / Blackwell & Co.

* Current from combined lighting and traction station. (1) Third Rail system. M—Motor Cars. T—Trail Cars.

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ELECTRIC TRAMWAYS & RAILWAYS.—Particulars of Track and Equipment.

Location of Line and Name of Operating Company.	Date of Opening of First Section.	Length of Route.	Total length of Track.	Gauge.	Weight and Type of Rail.	Maximum Gradient.	Sharpest Curve.	No. of Motor Cars.	No. of Dynamos	No. of Engines	Type of Engines.	Total Capacity Traction, kw.	Principal Contractors for Electrical Equipment
TRAMWAYS—*continued.*				ft. in.	lbs.	1 in	ft. rad.						
Leicester Corporation	May, 1904	20·25	38	4 8½	100 G	16	35	160	7	7	V.Cp.C&T	9,250	Dick, Kerr, & Co. / Blackwell & Co.
Leith Corporation	Aug., 1905	9·08	17·9	4 8½	106·7 G	19	54	37	*11	11	..	1,600	Brush & B.T-H.
Leyton Urban District	Dec., 1906	8·95	17·694	4 8½	105 & 111 G	24	45	60	*4	4	Cp.T.E&T	2,040	..
Lincoln Corporation (1)	Nov., 1905	1·75	2·96	4 8½	100 G	..	36	8	*9	9	..	120	Blackwell & Co.
Liverpool Corporation	Nov., 1898	70	124	4 8½	95, 123 & 134 G	13	30	599	*42	42	Trip.Ex.	44,600	British T-H. / Dick, Kerr, & Co. / Westinghouse
Liverpool Overh'd Ry. (Trol.Ln.Ex.)	June, 1900	2·5	2·5	4 8½	92½ G	Nil	40	14	7	7	H.&V.Cp.	160	Dick, Kerr, & Co.
Llandudno and Colwyn Bay ..	Oct., 1907	8·37	13·60	3 6	90 G	11·5	45	18	*	..	..	..	Bruce-Peebles.
Llanelly and District	July, 1911	6·25	6·75	4 8½	90 G	11·2	60	12	*2	2	Trip.Ex.	..	British T-H.
London County Council (2) ..	May, 1903	148·56	287·35	4 8½	105 G	10·6	45	1725M 150T	8	8	V. Cp. C. Turbine	43,000	Dick, Kerr, & Co. / Westinghouse
London United Tramways Co. ..	April, 1901	55·25	102·45	4 8½	92½ & 100 G	18	28	339	7	5	V. Cp.	3,500	British T-H. / Westinghouse. / Blackwell & Co.
Lowestoft Corporation	July, 1903	4·75	5·07	3 6	100 G	27	36	19	*5	5	Cp.	..	Blackwell & Co.
Luton Corporation Tramways (Leased to J. G. White & Co., Ltd.) ..	Feb., 1908	5·25	6·25	4 8½	95 G	11	35	12	*1	1	..	..	J. G. White & Co. / British T-H.
Maidstone Corporation	July, 1904	5·5	7·04	3 6½	96 G	9	35	19	3	3	..	750	Dick, Kerr & Co.
Manchester Corporation	June, 1901	120·05	244	4 8½	105 G	14·9	35	685	*22	22	Turb'nes	45,300	British T-H. / Dick, Kerr, & Co.
Mansfield and District Co. ..	July, 1905	10	12·25	4 8½	90 G	17	50	24	*3	3	..	..	
Merthyr	April, 1901	3·69	4·81	3 6	96 G	11	66	16	*4	4	H.S.V.	..	D. K. & B. T-H
Metropolitan Electric Trys., Ltd.	July, 1904	56·25	112·5	4 8½	100 G	12	40	312	5	5	1 Stm. Tur	..	British T-H. / Brush Co.
Mexborough & Swinton Trys. Co.	Feb., 1907	7·75	10·75	4 8½	90 G	8·5	55	20	4	4	Turb.	700	Brush & B.T-H.
Middlesbro', Stockton, & Thornaby Electric Tramways Co.	July, 1898	10·5	15·825	3 6	92½ G	17	35	60	3	4	H.&V.Cp.	900	British T-H. / Blackwell & Co.
Middlesex County Council	Aug., 1904	25·5	51	4 8½	..	..	..	..	..	..	..	..	
Middleton Corporation	March, 1902	2·5	5	4 8½	..	..	..	..	..	..	..	..	
Middleton Electric Traction Co. ..	March, 1902	8·5	10·53	4 8½	90 G	15	49½	28	3	3	..	500	Glover & Co.
Morecambe	Jan., 1912	1·20	..	4 8½	96 G	18	..	4	..	..	..	..	
Musselburgh and District ..	Dec., 1904	6·5	8·125	4 8½	90 G	34	45	16	4	3	..	400	B. T-H. Co., Nat. Elec. Cons. Co.
Nelson Corporation	Feb., 1903	2·74	3·86	4 0	106 G	11	41	11	*4	4	..	400	Blackwell & Co. / British T-H. Co. / Brush Co.
New St. Helens & District Trys. Co.	July, 1899	18	20	4 8½	95 G	13	35	36	*4	4	V. Cp. C.	..	Westinghouse / British T-H.
Newcastle Corporation	Dec., 1901	32·75	69·5	4 8½	101 G	11	37	220M 2 T	6	6	V. Cp. Trip. Ex. & Turb.	11,000	Westinghouse / British T-H.
Newport (Mon.) Corporation ..	April, 1903	7·5	14·35	4 8½	98 G	10·5	40	44	5	5	V. Cp.	1,750	Westinghouse
Northampton Corporation	July, 1904	6·5	12·5	3 6	90 & 96 G	18	50	33	4	4	V.C.C.&T	1,020	Dick, Kerr, & Co. / Brush Co.
North Shields Tramways Co. ..	March, 1901	..	7·75	3 6	90 G	10	36	22					
North Staff. Trys. (*vide* Potteries)													
Norwich Electric Tramways Co. ..	July, 1900	14·5	19·25	3 6	65½ & 90 G	12·6	38	42	6	5	H.TCp&T	1,000	Westinghouse / Blackwell & Co. / British T-H.
Nottingham Corporation	Jan., 1901	21·5	40·3	4 8½	107 G	11·5	40	155	*3	3	..	..	Dick, Kerr, & Co.
Nottinghamshire & Derbyshire Tramways Co.	Aug., 1913	12·8	16·10	4 8½	G	..	..	24	*	..	..	..	British T-H.
Oldham, Ashton & Hyde Trys. Co.	June, 1899	9·12	11·75	4 8½	97 G	11	28	46	*3	3	V. Cp. C.	..	British T-H.
Oldham Corporation	Dec., 1900	24	37	4 8½	100 & 105 G	10·5	40	109	*4	4	..	2,220	Dick, Kerr, & Co.
Paisley & District Tramways Co.	June, 1904	18·25	32·50	4 7¾	90 G	10	34	60	..	..	..	..	British T-H.
Perth Corporation	Oct., 1905	4·846	6·75	3 6	90 G	16	25	12	5	5	Cp.	500	Blackwell & Co.
Peterborough Elec. Traction Co. ..	Jan., 1903	5·33	6·71	3 6	94 G	31	35	14	..	..	..	..	Blackwell & Co. / Dick, Kerr, & Co.
Plymouth Corporation	Sept., 1899	7·75	15	3 6	92 G	9	35	42	3	3	V. Cp.	..	Elec. Cons. Co. / Westinghouse
Plymouth, Stonehouse, and Devonport	Nov., 1901	1·5	3·62	3 6	84 G	11	34	15	..	..	..	..	Blackwell & Co. / Dick, Kerr, & Co.
Pontypridd Urban District ..	March, 1905	5·5	8·6	3 6	96 & 100 G	10	27·6	26	4	5	V.C.Cp.	450	B.I.W. & B.T-H. / Blackwell & Co.
Portmadoc & South Snowdon Rly.	Under cons.	13·25	15	1 11½	41	28	200	6	..	..	..	..	
Portsdown & Horndean Tramway	March, 1903	6	7·5	4 7¾	96 G	16	40	16	2	2	Oil	200	Dick, Kerr, & Co. / Brush Co.
Portsmouth Corporation	Sept., 1901	17·65	34·63	4 7¾	96 & 100 G	17	35	100	5	4	V.& H.Cp.	2,075	Macartney & Co. / Dick, Kerr, & Co.
Potteries Electric Traction Co. ..	May, 1899	31·67	41·48	4 0	87, 90, 100, & 110 G	11	45	110	8	8	H.Cp. / V.Cp.	2,275	Dick, Kerr, & Co. / Blackwell & B.T-H.
Preston Corporation	June, 1904	10·54	17·2	4 8½	B.S.S. No. 2	16	28	39	2	2	H.Cp.	600	Dick, Kerr, & Co.
Radcliffe Urban District ..	April, 1905	5	6·5	4 8½	100 G	15	40	..	*4	4	V. Cp.	600	Mather & Platt
Rawtenstall Corporation	May, 1909	12	15·9	4 0	100 G	15	38	24	*3	3	..	850	Westinghouse
Reading Corporation	July, 1903	7·44	13·175	4 0	96 G	16	35	36	4	4	V. Cp.	400	Blackwell & Co. / Dick, Kerr, & Co. / Westinghouse
Rhondda Tramways Co.	July, 1908	21	28·75	3 6	95 G	9	38½	54	7	4	Trip.Ex.	1,230	British T-H. / Brush
Rochdale Corporation	May, 1902	19·58 (A)	40 (A)	4 8½	103½ G	11·7	30	69	*	..	..	..	British T-H. / Dick, Kerr, & Co. / Brush Co.
Rotherham Corporation	Jan., 1903	10	12	4 8½	100 G	9·5	45	36	*6	6	H.S.Cp.	1,485	Dick, Kerr, & Co.
Rothesay	June, 1902	4·81	9·68	3 6	94 G / 77 G	24	34	20	3	3	V. & Oil	350	Dick, Kerr, & Co.
Ryde Pier, Isle of Wight Ryde Pier Co. (3) ..	March, 1886	·5	1	4 8½	30 & 34 V	..	..	4	2	2	Gas	..	Westinghouse / Siemens Bros.
Salford Corporation	Oct., 1901	41·90	75·79	4 8½	103 G	20	42·5	220	*7	7	C. & Turb.	3,000	Westinghouse / Mather & Platt
Scarborough Tramways Co. ..	May 1904	5	7·75	3 6	90 G	10·5	35	22	2	2	Stm.Turb.	..	Brush & B.T-H.
Sheerness and District	April, 1903	2·5	2·704	3 6	94 G	43	40	8	6	5	V.Cp.C.	100	Siemens & Halske / Brush Co.
Sheffield Corporation	Sept., 1899	40	77·84	4 8½	110 & 120	9·5	35	339	..	..	..	..	British T-H.

* Current from combined lighting and traction station. (1) G.B. surface contact system. (2) Mainly Conduit system, but there are now several Trolley lines. Besides the electric lines the London County Council has also 4·45 route miles of horse tramways. (3) Third rail system. (A) Not including 17·1 miles track leased.
M—Motor Cars. T—Trail Cars.

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ELECTRIC TRAMWAYS (contd.).	Date of Opening of First Section.	Length of Route.	Total Length of Track.	Gauge.	Weight and Type of Rail	Maximum Gradient.	Sharpest Curve.	No. of Motor Cars.	No. of Dynamos	No. of Engines.	Type of Engines.	Total Capacity Traction, Kw.	Principal Contractors for Electrical Equipment.
				ft. in.	lbs.	1 in	ft. rad.						
Shipley Urban District	May, 1902	6	10	4 0	98 G	15	..	..	6	6	Turbine	1,800	British T-H.
Soothill Nether U.D.C. & Dewsbury & Ossett Corporations	Nov., 1908	3·125	4·45	4 8½	90 G	13	50	8	*	..	..	..	Nat. Elec. Cons. Co.
Southampton Corporation	Jan., 1899	10·25	18·75	4 8½	96 G & 105 B.S. No. 4	13	40	73	6	6	H. Cp. C.	1,000	Westinghouse
Southend Corporation	July, 1901	7·01	15·2	3 6	90 G	18	48	42	*6	7	V. Cp.	2,075	British T-H.
Southend Pier (1) Southend Corp.	Aug., 1890	1·25	1·25	3 6	60 G	Lev.	..	28	..	..	..	..	British T-H.
South Metropolitan Elec. Try. Co.	Feb., 1906	13·09	26	4 8½	95 G	16	42	51	*8	6	Stm Tbs	1,650	Dick, Kerr & Co. / Brush Co.
Southport Corporation (5)	July, 1900	13·5	10·75	4 8½	87 & 90 G	25	45	30	*3	3	H. Cp.	600	Dick, Kerr, & Co.
Southport Electric Tramway Co.	July, 1901	8·17	12·52	4 8½	87 G	Nil	40	21	*				
Southport Pier	1905	..	·75	4 0	..	..	..	1 M 2 T	..	..	..	..	Westinghouse
South Shields Corporation	March, 1906	5·7	10·25	4 8½	95 G	15	35	40	2	2	V. Cp. C.	1,100	Dick, Kerr & Co.
South Staffordshire	Jan., 1893	16·90	26·87	3 6	97 & 90 G	17	46	46	3	3	C.H. Cp.	..	Blackwell & Co. / E. C. C.
Stalybridge, Hyde, Mossley, and Dukinfield	May, 1904	21·186	27·75	4 8½	99 G	9	27½	59	8	..	Turb.	1,000	Dick, Kerr, & Co.
Stockport Corporation	Aug., 1901	16	27·62	4 8½	96 G	10·8	35	50	*5	5	Cp.	1,000	Dick, Kerr, & Co.
Sunderland Corporation	Aug., 1900	10·92	20·35	4 8½	96 G	12	36	70	*	..	..	936	Dick, Kerr, & Co.
Sunderland District Electric Trys.	June, 1905	14·27	15·97	4 8½	90 G	11	40	33	*	..	..	..	British T-H.
Sutton & Howth (G.N.R., Ireland)	June, 1901	5·3	6	5 3	72 B	16·7	300	11	3	3	V. Cp.	500	British T-H. / Westinghouse
Swansea Tramways Company	June, 1900	13·02	20·38	4 8½	84 & 86 G	14	45	75	3	3	H. Cp. C.	620	British T-H.
Swindon Corporation	Sept., 1904	3·7	4·4	3 6	105 G	14	37	12	5	4	..	600	Dick, Kerr & Co.
Taunton Electric Traction Co.	Aug., 1901	1·66	2	3 6	90 G	25	35	6	*	..	..	..	Blackwell & Co.
Torquay Tramways	April, 1907	9·76	17·04	3 6	90 G	10	31	33	*	..	..	..	British T-H.
Trafford Park Estates, Ltd. (Trys.)	July, 1903	2·5	2·75	4 8½	100 G	Nil	35	..	..	..	..	..	
Tynemouth and District	March, 1901	4·21	7·83	3 6	90 G	10	30	21	*3	3	..	..	Blackwell & B.T-H.
Tyneside Tramways & Tramroads Co.	Sept., 1902	10·97	16·23	4 8½	95 G	10	40	24	*				
Wallasey Corporation	March, 1902	12	20	4 8½	98 G	11	40	67	*1	1	Turbine	1,000	Blackwell & Co.
Walsall Corporation	Jan., 1904	13·5	19·5	3 6	90 & 92 G	18·5	32	39	*7	7	V. & Tur.	2,490	British T-H.
Walthamstow U.D.C. Light Rly.	June, 1905	9·14	12·53	4 8½	100 G	18	40	38	*15	12	Gas & Turb's	1,560	Westinghouse
Walton-on-Naze Pier	Aug., 1898	·5	·5	3 6	36 V	..	..	3	3	2	..	100	Blackwell & Co.
Warrington Corporation	April, 1902	6·5	9·6	4 8½	90 G	27	50	21	*6	6	V.C.	500	British T-H.
Wemyss and District	Aug., 1906	7·5	13	3 6	95 & 97 G	18	85	17	3	3	2 V. Cp.	..	Bruce Peebles & Co.
West Bromwich Corporation	Dec., 1902	7	12·5	3 6	98 G	20	49	29	8	8	Turb'nes	750	Dick, Kerr, & Co. / B. I. W. Co.
West Ham Corporation	Feb., 1904	16·8	30·0	4 8½	100 G	18	40	118	*3	3	V.C.Cp.	1,500	Brush & B.T-H.
West Hartlepool Corporation	May, 1896	6·72	8.3	3 6	87 & 90 G	15	35	25	*	..	..	..	Elec. Cons. Co. / Dick Kerr & Co.
Weston-super-Mare	May, 1902	2·92	3·53	4 8½	90 G	25	40	12	5	4	Cp. & T.	..	Blackwell & Co. / British T-H. / Brush Co.
Wigan Corporation	Jan., 1901	30·9	45·42	3 6 / 4 8½	105 G	12	45	73	*8	8	..	740	Blackwell & Co.
Wolverhampton Corporation (3)	April, 1902	13·5	22	3 6	91 G	15	37·5	52	*10	10	H. & V.C. & Turb's	2,900	British T-H. / Electric Cons. Co.
Wolverhampton District	Oct., 1900	15·51	22·72	3 6	90 G	20	40	30	*4	..	..	..	B.I.W. & B.T-H. / Westinghouse
Worcester Electric Traction Co.	Feb., 1904	5·86	8·58	3 6	94 G	13	45	15	*3	3	..	..	Brush Co. / Dick, Kerr, & Co.
Wrexham and District	April, 1903	4·44	6·16	3 6	96 G	9·11	50	10	*6	..	..	..	British T-H.
Yarmouth Corporation	June, 1902	10	14·4	3 6	90 & 95 G	27	48	35	3	3	Comp.	..	Brush Co. / B.I.W. Co.
York Corporation	Jan., 1910	6	9·9	3 6	100	18	40	3 M. 4 T.	*8	8	V.C.	..	Dick, Kerr, & Co. / Brush & B.T-H.
Yorkshire (West Riding)	Aug., 1904	24·69	40·382	4 8½	96 G	15·5	40	69	9	6	..	1,800	Dick Kerr & Co.
Yorkshire Woollen District	Feb., 1903	22·25	36	4 8½	94 & 100 G	8	30	69	*	..	..	..	Brush Co. / Dick, Kerr, & Co.
RAILWAYS.													
LONDON AND VICINITY:													
Central London Rly. Co. (1)	July, 1900	6·5	13	4 8½	100 V	30	..	68 M. 172 T.	6	6	H. Cp. C.	..	British T-H
City & South London Rly. Co. (1	Dec., 1890	7·25	14·75	4 8½	60 V / 80 V	30	120	52 L. 142 T.	(a)	..	..	..	Mather & Platt. / Elec. Cons. Co.
East London Railway (2)	April, 1913	5·75	11·5	4 8½	90 B	..	..	(c)	..	..	..	..	British T-H.
Gt. Northern & City Rly. Co. (2)	Feb., 1904	3·5	7·75	4 8½	85 V	52	660	35 M 45 T	6	..	..	..	British T-H.
Great Western Railway (Hammersmith and City line.)	Nov., 1906	4·9	10·5	4 8½	97½ B	60	400	46 M. 60 T.	10	10	V. Cp.	..	British T-H. / Elec. Con. Co.
London & North Western Rly. (Euston-Watford line in progress) (2)	May, 1914	41·5	80	4 8½	..	..	..	..	..	..	Turbine	..	Siemens Works / Westinghouse
London & South Western Rly.	Nov., 1915	47	150	4 8½	..	..	168	84	..	..	Turbine	..	Dick, Kerr & Co. / British T-H. / Westinghouse
London, Brighton, and South Coast Railway (4) (Extensions in progress)	Dec., 1909	22	70	4 8½	..	..	..	16 M. 8 T.	*(d)	..	..	..	British T-H. / Blackwell & Co.
London Electric Railway Co.: Baker St. & Waterloo Ry. (2)	March, 1906	7	14·0	4 8½	90 B	60	330	86 M. 72 T.	(a)	..	..	..	Westinghouse / British T-H.
Charing Cross—Hampstead Railway (2)	June, 1907	8	16·5	4 8½	90 B	33	330	60 M. 90 T.	(a)	..	..	..	Westinghouse / British T-H.
Great Northern, Piccadilly & Brompton Rly. (2)	Dec., 1906	9·25	18·5	4 8½	90 B	33	330	72 M. 144 T.	(a)	..	..	..	Westinghouse / British T-H.
Metropolitan Railway (2)	Jan., 1905	26	59	4 8½	86 B	44	363	86 M. 172 T	4	4	Turbine	..	Westinghouse / British T-H.
Metropolitan District Railway (and running powers) (2)	July, 1905	41	80·46	4 8½	86 B	40	330	284 M. 286 T.	(a)	..	Turbine	..	British T-H. / Westinghouse
Waterloo and City Rly. (1)	Aug., 1898	1·5	3	4 8½	87 B	30	321	17 M. 12 T.	6	6	V. C.	..	Siemens Bros. / Dick, Kerr & Co.
PROVINCES:													
Lancashire and Yorkshire (2) (Extensions in progress)	March, 1904	43	85	4 8½	86 B	85	840	38 M. 52 T.	6	5	1 V.C. / 4 H.C.	..	Dick, Kerr, & Co.
Liverpool Overhead Rly. Co. (1)	March, 1893	6·5	13·05	4 8½	60 V	40	429	46 M 7 T	7	7	H.Cp. / V.Cp.	..	Electric Cons. Co. / Dick, Kerr, & Co.
Mersey Railway (1)	April, 1903	4·5	9	4 8½	86 B	27	528	24 M. 87 T.	5	5	V. Cp.	..	Westinghouse
Midland Rly.—Morecambe and Heysham Branch (4)	June, 1908	9·75	19·5	4 8½	..	..	..	8 M. 6 T.	4	4	Gas.	..	Westinghouse / Siemens Bros.
North Eastern Railway (1)	March, 1904	..	..	4 8½	90 B	..	..	..	(b)	..	..	..	British T-H. Co.

*Power from combined lighting and power station. (1) Third rail system. (2) Third and fourth rails system. (3) Lorain surface contact system. (4) Single phase. (5) Not including 9 miles owned but leased. (a) Power supplied by Chelsea Power Station (80,000 H.P.) (b) Power purchased from the Newcastle-upon-Tyne Electric Supply Company, Limited. (c) Rolling stock supplied by Metropolitan Railway. (d) Power supplied by London Electric Supply Corporation.
M—Motor Cars. T—Trail Cars.

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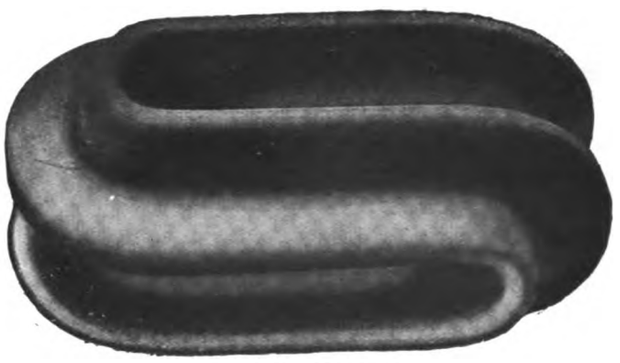

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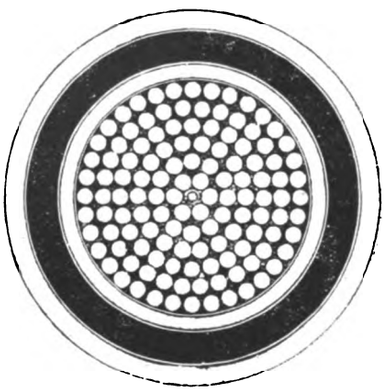

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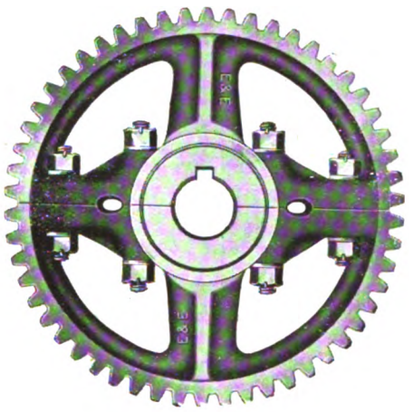

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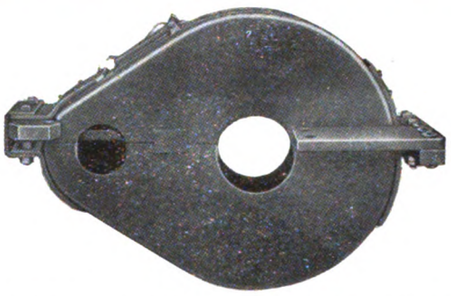

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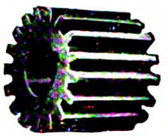

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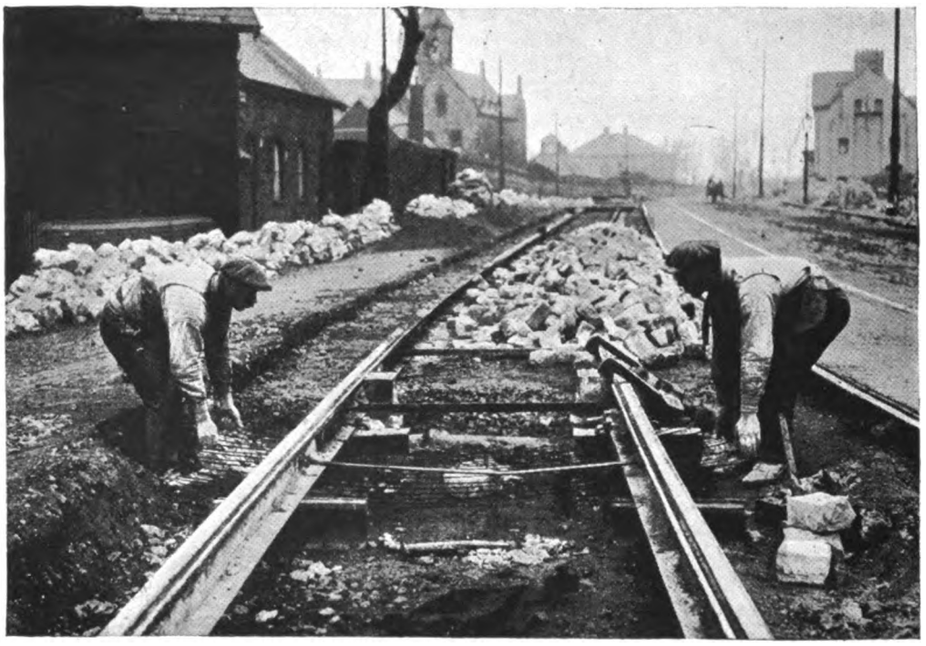
TRAMWAY FOUNDATIONS



Belfast Corporation Tramways. Borough Engineer: H. A. Cutler, Esq., M.I.C.E.
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B.R.C. Fabric laid in sheets in the concrete foundation transversely to the rails, so strengthens the foundation that the wheel loads are spread over the full width of ground below the concrete. The result is a level track.

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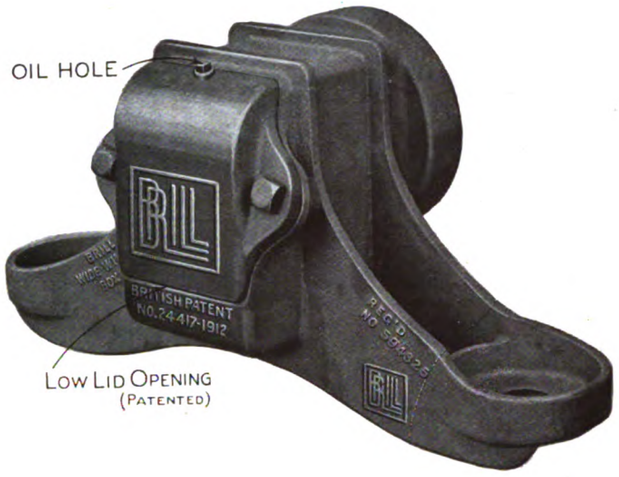

Brill Wide-Wing Journal Box *(Patented)*

THE Brill Wide-Wing Journal Box increases the lower spring base 7″ more than the short-wing journal box. Cradling the springs at points farther apart steadies the car—pitching is arrested—breaks up galloping movement—relieves the side frame of stresses at the yokes; note the webs carried over the top of the box, giving strength and rigidity. The Low-Lid Opening is the Brill Patented construction; no need to jack up car to get at oiler—simply swing lid to one side, exposing the oiler for any attention. The large, extra oil hole in top of lid is for temporary or periodical oiling: just unscrew plug at top of lid and run oil into the box. The Brill Patented Wide-Wing Journal Box is 13 lbs. lighter than the standard grey iron box—made in malleable iron—approximately 12% stronger than the usual grey iron box—*interchanges with the existing Brill short-wing journal box*, the same interior fittings being adaptable. A lighter and stronger box in every way, embodying real practical advantages—cars ride easier and steadier—inexpensive, and we deliver in a few days.

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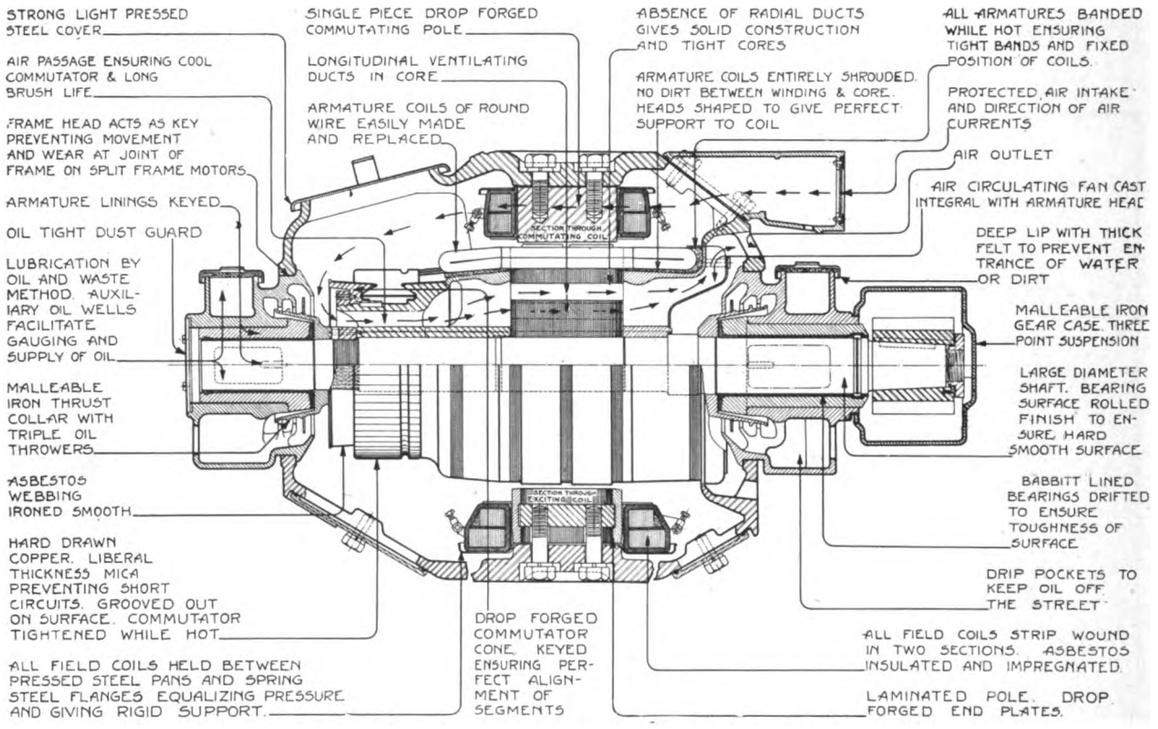
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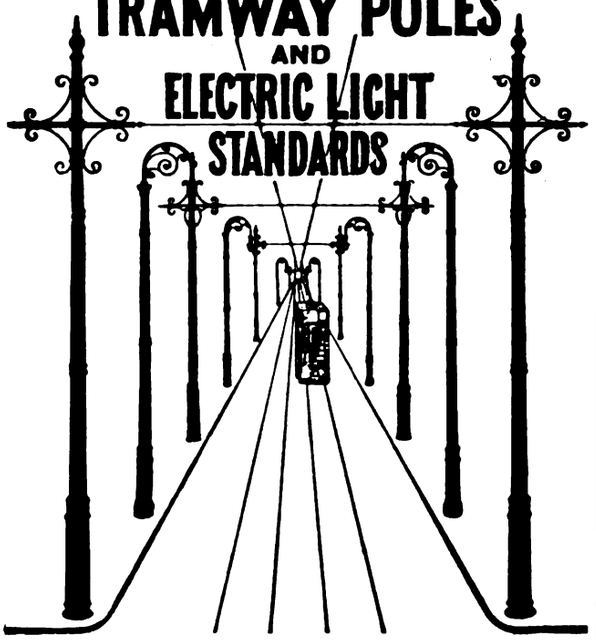

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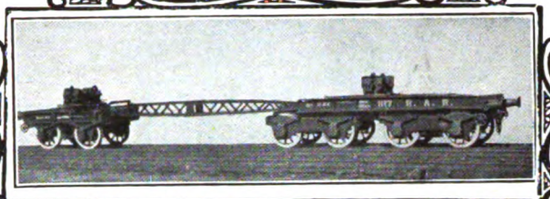

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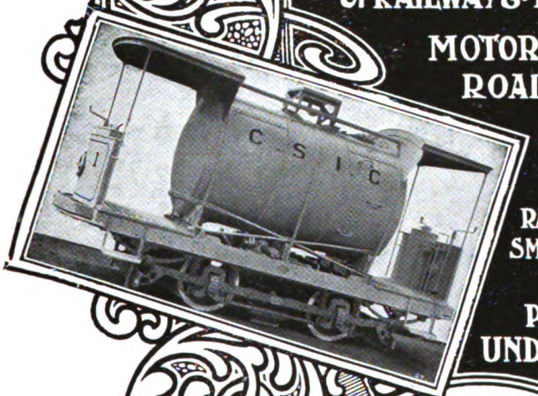

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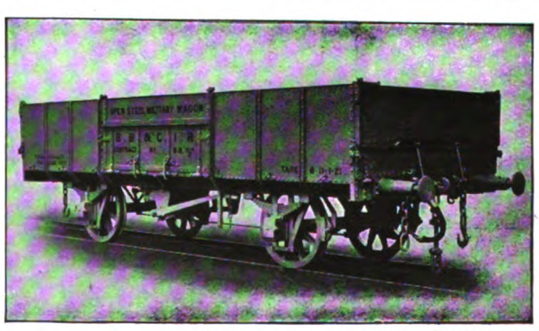

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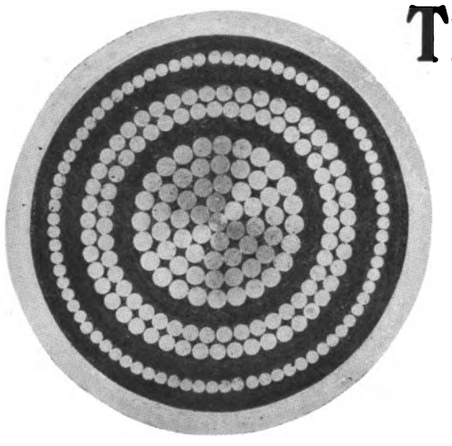

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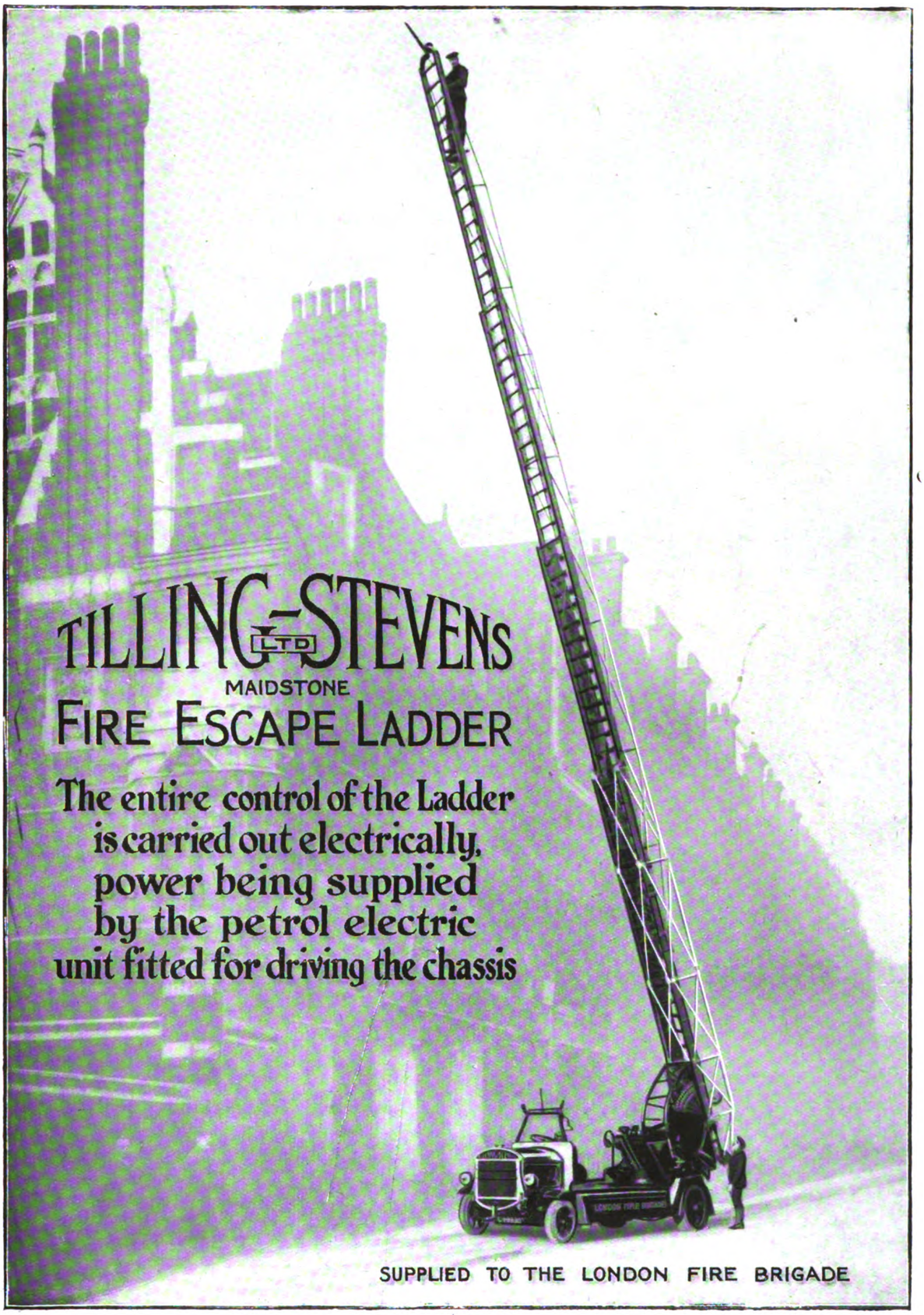
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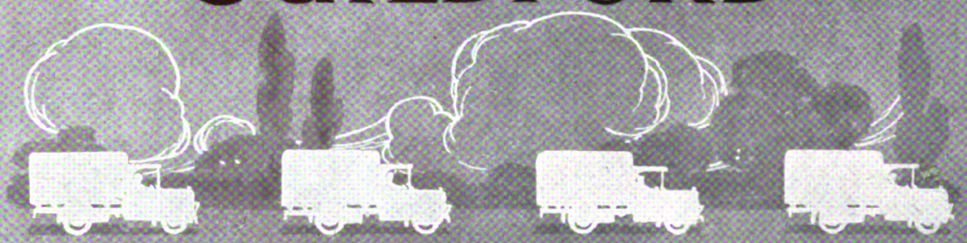

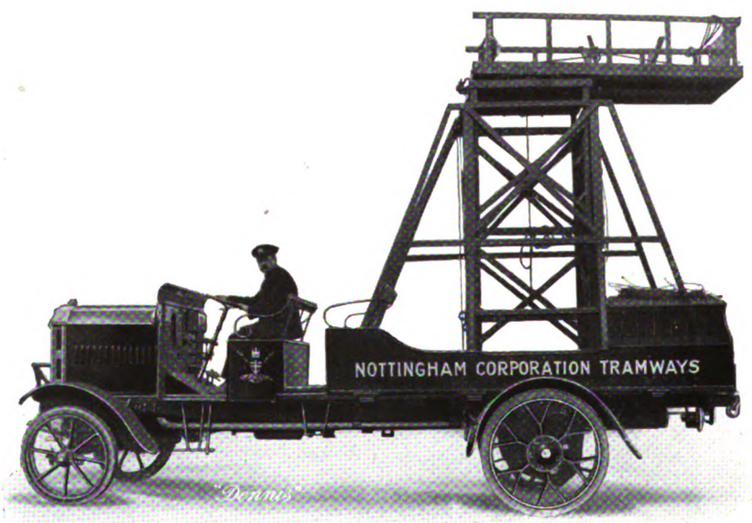

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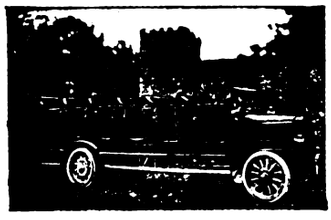

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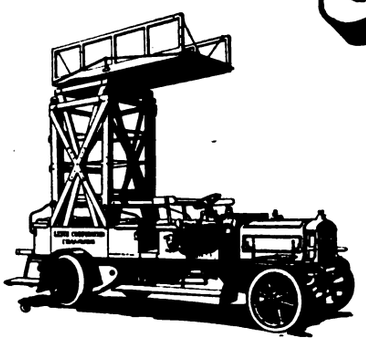

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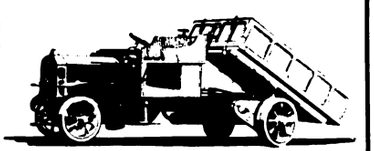

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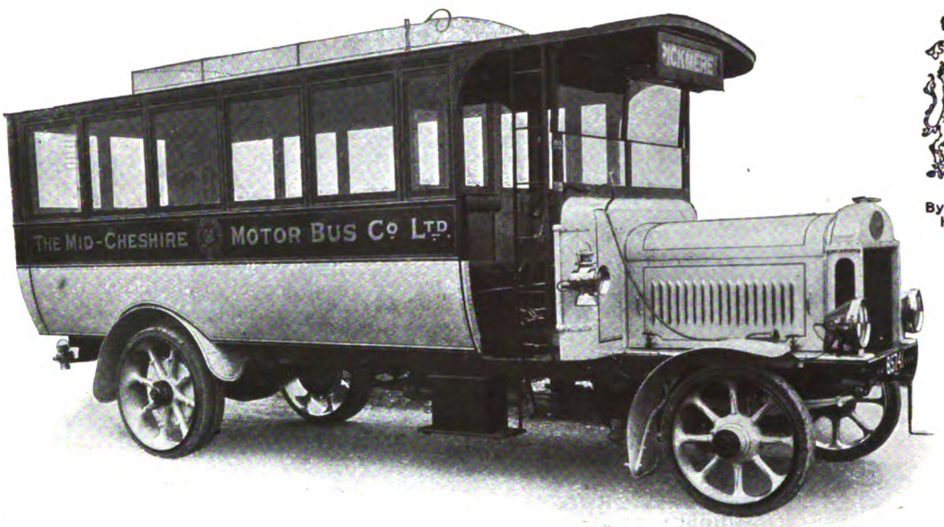

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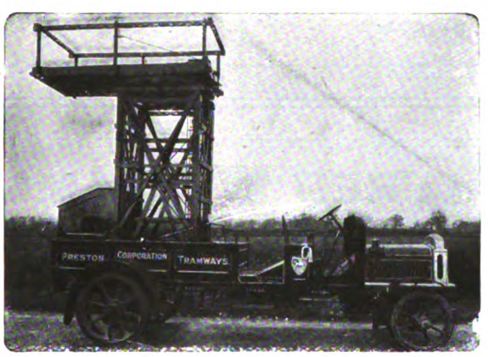

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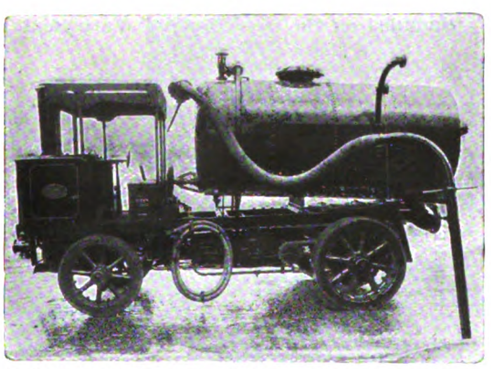

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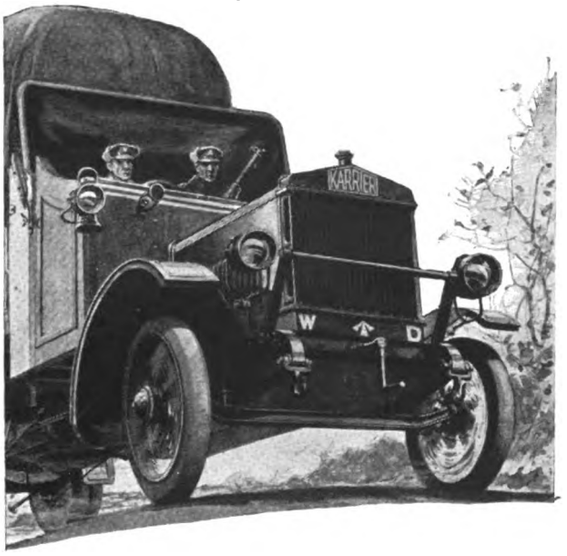

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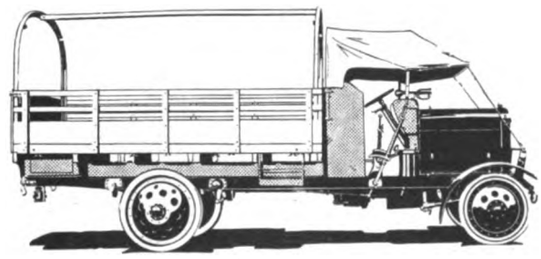

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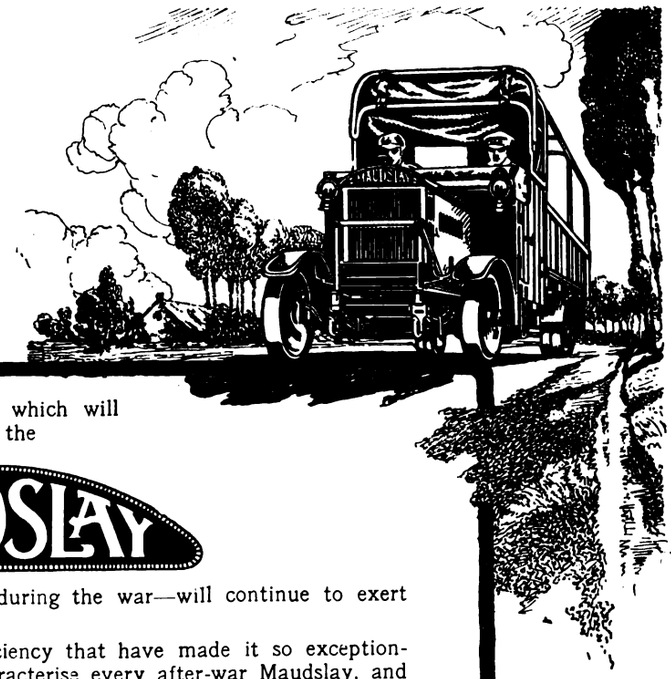

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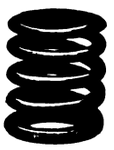

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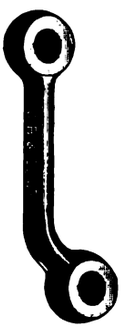

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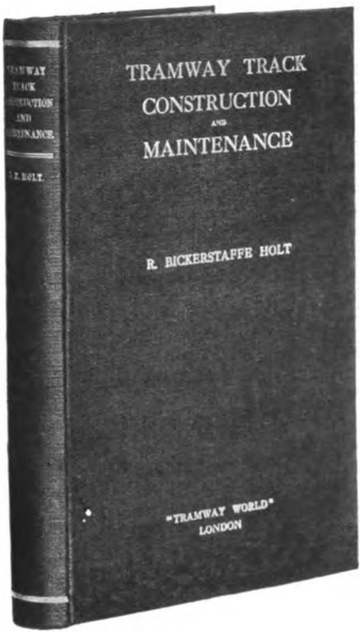

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"What's wrong with the Track?"

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Road metal—Water gravel—Sand—Clinker sand—Trass.

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Bad rail packing—Rails canted or twisted—Anchoring and padding—Rail expansion and contraction—Curving of rails—Springing of rails—Anchoring new tracks.

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Why joints fail—Dished or hammered joints—Movement at joints.

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Methods of welding—Thermit welding—Electric arc welding process—Expansion and contraction—Oxy-acetylene process.

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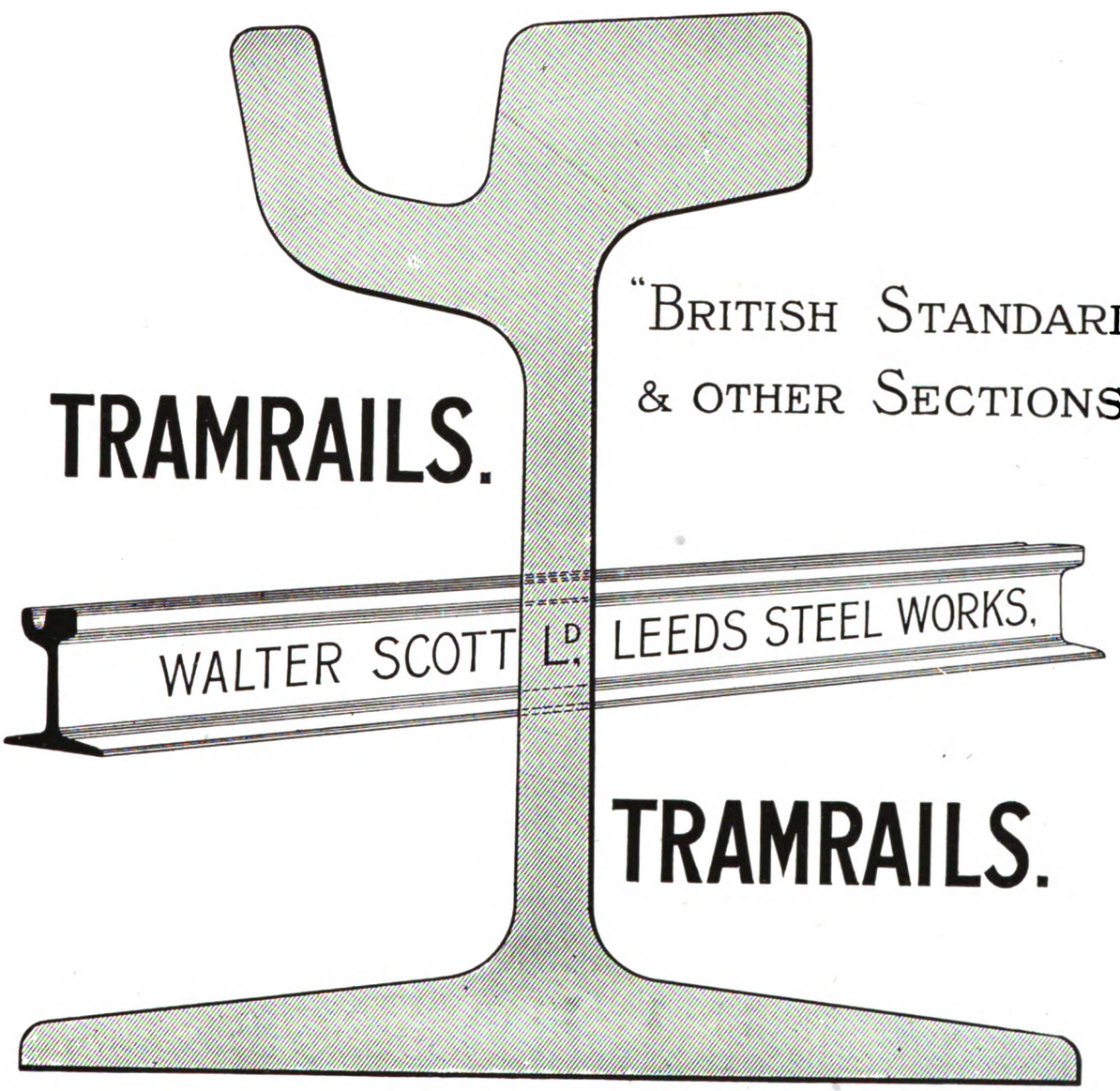

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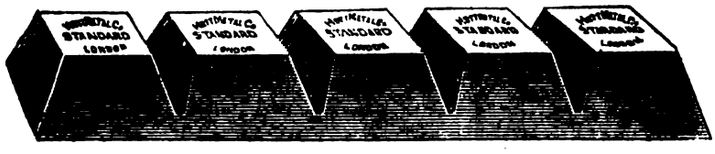

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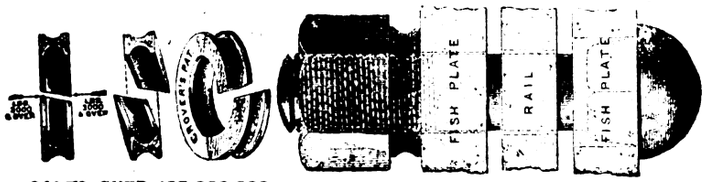

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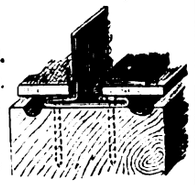

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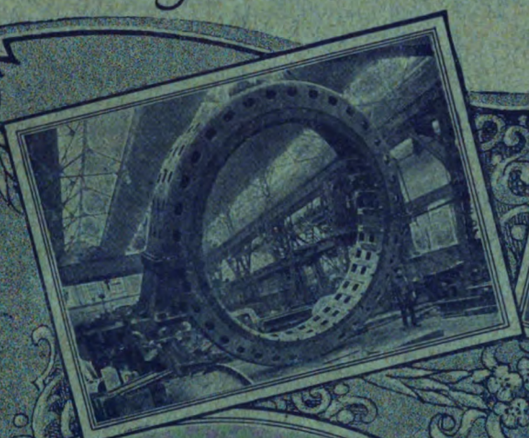
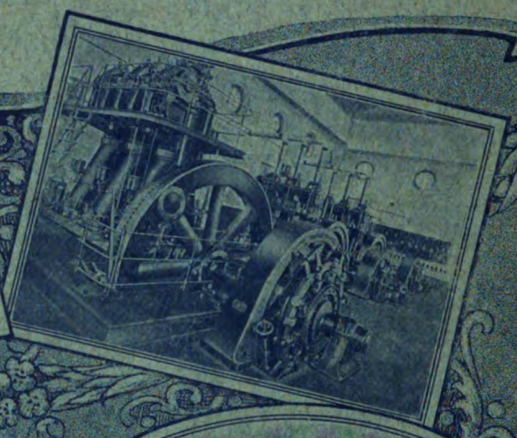
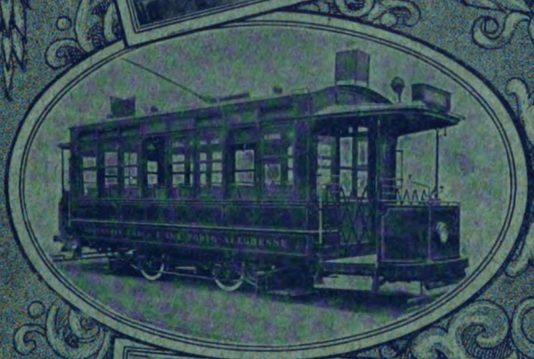

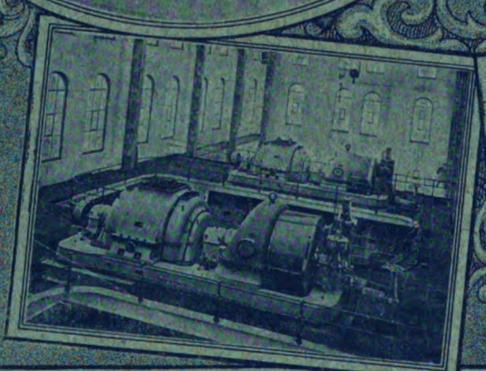

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